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INSTITUTE OF JAMAICA.

POPULAR LECTURES.

FIFTH SERIES.

LECTURES FIRST AND THIRD.

FIRST:

On the Geology of Jamaica.

THIRD:

On Mining in Jamaica.

FEBRUARY, AND MARCH, 1889,

BY

REV. HORACE SCOTLAND.

JAMAICA:
MORTIMER C. DESOUZA, PRINTER,
7, Church St., Kingston.

1890.

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INSTITUTE OF JAMAICA.

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LECTURES FIRST AND THIRD.

FIRST:

On the Geology of Jamaica,

GIVEN AT THE
INSTITUTE ROOMS, KINGSTON,
—ON—
WEDNESDAY, 6th FEBRUARY, 1889.

" The riddle of the painful Earth!"

THIRD:

On Mining in Jamaica,

RETROSPECTS and PROSPECTS,

GIVEN AT THE
MICO INSTITUTION, KINGSTON,
—ON—
5th MARCH, 1889.

"RESPICE! (ASPICE) PROSPICE!"

—BY—

HORACE SCOTLAND,
MISSION PRIEST OF ST. MATTHEW'S, ALLMAN TOWN, KINGSTON, AND
CHURCH OF ENGLAND CHAPLAIN TO H. M. TROOPS, UP-PARK CAMP,
ST. ANDREW'S, JAMAICA.

◆

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Lecture First—ON THE GEOLOGY OF JAMAICA.

	Pages.
Part 1st—Educational	3 to 11
IInd—Speculative	11 to 17
IIIrd—Economic	17 to 31
IVth—Scientific	31 to 48

◆

Lecture Second—ON MINING IN JAMAICA.

Part 1st—Introduction	1 to 7
IInd—Aspects	7 to 12
IIIrd—Retrospects	12 to 21
IVth—Prospects	21 to 42

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Lecture First ON THE [illegible] MAICA.

Page
[illegible] 3

[illegible] MINING [illegible] MAICA.

[illegible] 1 to 7
[illegible] 7 to 1[illegible]

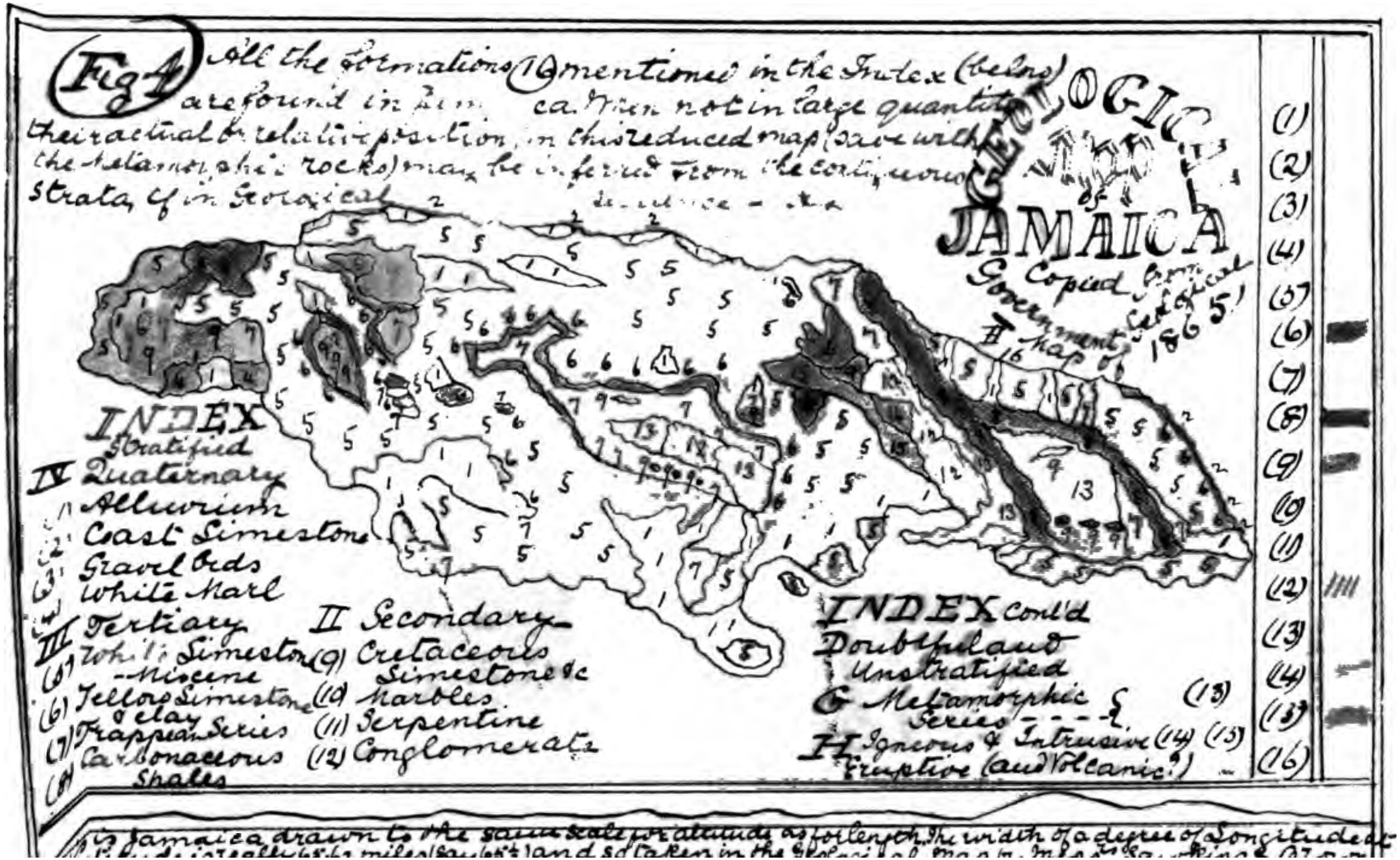

Fig 4

All the formations (16) mentioned in the Index (below) are found in Jamaica when not in large quantity their actual & relative position in this reduced map (save with the Metamorphic rocks) may be inferred from the contiguous strata & in Geological sequence — &c

is Jamaica drawn to the same scale for altitude as for length the width of a degree of Longitude at

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ERRATA ET CORRIGENDA,

LECTURE 1ST.

Page 3—5th line from foot, read " hazard."
" 5—21st line, read " track."
" 5—1st line of sect. (g), read " divertisements."
" 6—4th line from foot, read " ptero-dactyles."
" 7—17th line of sect. (i), read " led."
" 9—3rd line of sect. (j), for " was" read " were."
" 9—5th " " " "it" read " them."
" 9—7th " " " "lead" read " led."
" 11—7th line from top, read " Micawber."
" 14—Insert foot note to sect. (f) thus—"See Lect. 2nd, part 1st, sect. (e)
" 18—line 21, read " terrestrial."
" 18—line 12, read " quarrying."
" 19—9th line of sect. (e), "*five-eighths.*"
" 19—last line, read " track."
" 22—line 15, read " streets."
" 23—4th line of sect. (i), read " quartz-itie."
" 23—8th line from foot, read " tarpaulin."
" 23—last line of foot-note, after " glue" insert " or glycerine."
" 24—7th line of sect (k) for paris, read " Paris."
" 24—5th line from foot, read " carnelians" (*i.e.* flesh stones.)
" 25—lines 27 and 28, read Kaffer, (bis.)
" 26—line 2, put) after " Esq."
" 26—line 11, after " Clarendon" insert " Metcalfe."
" 27—5th line of sect. (o), read " civilized."
" 33—9th line of foot-note, read " Jamaica) : And"
" 34—18th line, read " exactly "
" 34—25th line, read " stratified, or unstratified."
" 36—Put section letter (g), before " I have prepared."
" 38—3rd line of sect. (i), read " eluding."
" 38—13th line of sect. (i), read " stratified."
" 43—7th line of page, dele " yet," and after " much granite" put " however."
" 43—last line, read " three-eighths."
" 49—line 21, for " judgment" read " sentence."

ERRATA ET CORRIGENDA—(Continued).

LECTURE 2ND.

Page 6—2nd foot note, after "*mock-pearls* ;" insert "even fundamental granite is most probably meta-morphic."
" 8—line 16th, read "readily."
" 12—line 11th, read "Æsopian."
" 16—line 4th, dele) after "Vulgate."
" 17—24th line of sect. (g), read "*two dozens*" "*a dozen dozens.*"
" 21—line 29, for "rung" read "rang."
" 23—8th line of sect. (c), after "right" insert "to."
" 29—3rd line of sect. (m), for "there" read "then."
" 34—9th line of sect. (r), read "direction."
" 34—2nd foot note, line 4th, read "drove."
" 35—7th line of sect. (t) read "globigerinous."
" 37—20th line, read "breeze"
" 38—1st foot note, 1st line of couplet, read
"Who dared Kildare to kill ?"
" 39—8th line of sect. (u) read "page 35."

All other errors are committed to the charitable judgment and kindly correction of the reader. Not having forgotten the words of Thales "That it is the hardest thing to know our own faults ; the easiest to detect the faults of others" ;—nevertheless the writer indiscreetly undertook to correct the proof-sheets of these Lectures, with the usual result ; since as La Fontaine says (after ii. Sam., xii, 5) "We are lynx-eyed towards our neighbours ; but moles to ourselves."

"You've got a hole in you !" said the sieve to the needle.

Indian Proverb.[*]

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[*] Compare with St. Matt. vii. 3-5, where, I think, "hypocrite" means, one who takes upon himself to judge others ; rather than, one who acts a part or feigns a virtue : although - in real life—the two characters are closely allied, and not infrequently combined.

Lecture on the Geology of Jamaica.

Mr. Chairman, Ladies and Gentlemen,—

The subject entrusted to me this evening by the Governors of the Jamaica Institute, to bring before you, is the Geology of the Island on which we reside :—

Part 1st—Educational.—Section (*a*.)—I would, however, first solicit your consideration and special patience, while I make some remarks, bearing more or less directly on the educational, intellectual and disciplinary uses and advantages that may arise to us, (even in Jamaica,) from the study of our local geological indications. On this educational use of practical science generally, or in regard to Geology specially, I might quote largely, (as I have in my note and text books gathered largely,) from various authorities, whether philosophical theorists, or scientific experts and specialists; but I have only time now, under this head, to mention such names as Lord Bacon, the late Canon Kingsley, Carlisle, Emerson, (the philosophical poet of America,) Professors Huxley and Tyndall, the recently deceased R. A. Proctor, (Mathematician and Astronomer,) the Right Honorable George Goschen and Mr. Gladstone.

(*b*.) I do not, however, on the strength of these and other authorities claim for Geology, that it has, in regard to human social improvement and intellectual development, any *extra* moral virtues, or superior mental gifts, than are possessed by many of the arts and sciences; but it is second to few of them, in respect even to abstract and metaphysical adaptations; and physically (especially in regard to its health-giving, health-restoring and retaining effects) superior to most of them. In addition, then, to its practical uses, Geology will be found to be a very delicate, but efficient sharpener of the wits, and at the same time (to use a mixed metaphor) a very logical director of the perceptive and deductive, and even of the inductive faculties of the mind; and its necessary out-door activities and occasional calls for extra exertion—its risks of temporary exposure, privation, and even hazzard to limb and life, tend to strengthen the nerve-force, to exhilarate the circulation of the blood, and to harden the muscular tissues; indeed to tone up the whole, moral, mental and material fibre, as much as (and less expensively than) any field sports or athletic exercises and gymnastics can possibly do. An occupation, then, which, in its pursuit, leads naturally to the two-fold result of the *mens sana in corpore sano*, must be alike a source of profit, and a fountain of pleasure to all its experts, and even to the student of its rudiments.

(*c*.) Moreover, there is a silent and secret, yet sure and satisfactory reward to him, who will set himself to commune with Nature in any of her moods and manifestations, and through the vestibule of the material and the visible, we *may* (*if we can*) pass onward and upward to the enchanted ground of mental and ethical inspirations.

(*d*.) Thus, then, alike the poet, the musician, the artist—but no less so—the man of science, and the expert in practical arts and manipulative trades, (each and all of them,) have, I say, their special tests, their subtle, and most probably, metaphysical intuitions and perceptions. I came to know a young man in New York, who had acquired a very special faculty in sampling *cotton!* What he bought was always found to be worth a cent. or a farthing more per pound to the manufacturer, than what any one else bought at the market price. What *we* may think of (you and I) as only a happy guess, or lucky "fluke" on the part of the real man of letters, or master of physics, was from the first, on *his* part a sure induction, leading him on, in its turn, to further and fuller inductions and discoveries. Therefore let every man, in some way or other, submit himself to that pupilage of training and discipline, which experience, on the part of others, proves, will develope within him also, that power and perception. Now, I claim that the study of Geology will do this, at least, as well as any other physical study or pursuit is capable of doing.

(*e*.) If time permitted, and your patience would hold out, I should like to say much more pertaining, at least, collaterally to this disciplinary purpose. Of higher and still purer consolations, I do not stand here to-night, to speak; but I will now only remind you that there may be true comfort and great consolation, as well as useful knowledge and an inner sense of capacity and capability to be gained from such studies, as I am now advocating—Geology foremost among them. I would, however, as more directly pertinent to my subject at large (as I hope to shew) now chiefly press the advantages of such occupations, as a relief to monotonous, secluded, and, unexciting *bread-earning*. Permit me then to tell how I became a Geologist—if I may presume to call myself such —I, who am less than the least of all scientists, and am not meet to be called a Geologist, or at most and at best, I know very little of that science, and such knowledge as I have, came to me somewhat late and in middle life.

(*f.*) Pardon, then, a few personal reminiscences. For twelve years I was the clergyman of the upland districts of the parish of St. John. If you approach Lluidas Vale by way of Ewarton and Swansea Coffee Mountain, the "Vale" with the Worthy Park cane-pieces, works, and residences,—with the little church in the centre of the enclosed plain, will strike you as very picturesque and beautiful, and no less so when you look beyond at the sweeping amphitheatre of hills, with Juan-de-Bolas mountain towering like "topmost Gárgarus," and clad to the summit in purple, green and "old gold;" with the Clarendon and Lemon Hall ridges on either hand, fading away in the distance in olive and russet and neutral greys. But on the other hand if you approach Lluidas Vale from Point Hill (and the Parsonage was *then* at Point Hill) *that* is about the dullest and dreariest six miles' ride, I think, that you could find in all Jamaica; at least it came to be so to me, who had to go up and down it three or four times a week, and in a very mixed assortment of weather. The Parsonage, and the new church, I built there (at Point Hill) are a little over 2,000 feet above sea-level, and Lluidas Vale about 1,000 feet below Point Hill, so it is a more or less steep descent all the way, much of it over a bad yellow clay road or tract, with lumps of loose, round, yellow limestone cropping up through the clay (like English school-boy's "hard-bake" or Jamaica "pinder cake.") In wet weather very bad to get over by daylight, and next to impassable at night. Such was my frequent travelling course. I was not idle, I had rather a large and laborious cure, and my life was monotonous, and the work, on the whole, wearisome and depressing.

(*g.*) I had indeed my little way-side divertisments and attractions. I knew, (the fact was patent,) that the clays were a good place for all kinds of ground orchids, including that most gorgeous one, the Bletia Tankevillia, (or ground cocoa-nut, as it is locally called,) with its stem 3 feet high, closely set with large, gaudy, variegated flowers in white, red and yellow, looking as if they had been stamped in, or cut out of thick Chinese rice-paper, and frosted over with powdered crystal. (By the way the bulbous root of this plant is just vegetable albumen, and might be utilized in the arts, and in refining or clarifying sugar on the estates.) I also knew that in the fringe of the lighter woods, between the clays and white limestones, was the place to find not too scanty supplies of the lace bark-tree (Daphne Veprecula;) although freely interspersed with its congener (Daphnopsis tinifola) the "Burn-nose" (or Bonace ?) and, alas! for the lace-bark worker who gets a Burn-nose faggot for a lace-bark; and I for one, with difficulty, learnt by *sight* to distinguish one from the other. But my trusty wood-man enabled me to send *in the season* (for cost and charges) many a mule load of lace-bark stakes to the late Mrs. Charles Campbell,—one of the founders and most energetic managers of the "Women's Selp-Help Society," of this city. (Kingston.) Then again, I found that the white limestone (not that ugly yellow stuff!) near the spray of the leaping, raging, but after all (save in flood time) not very abundant Roaring River, was the very home and paradise of ferns lycopodia and club-mosses, osmundas, adders-tongues and all the rest of them, flowering or sporular. So also it required but little observation and research to find indications and promises in the shape of defunct, and broken specimens, that the upper and drier white lime-stone woods are the habitat of most of our species of land shells. Indeed I have received letters from English Conchologists, because they had learnt that my district in Jamaica was the home of those very large and beautiful, but somewhat rare species of the "Cyclostoma" group, the "Choanapomum pulchrius" and "pulcherrimum," and Mr. Henry Vendryes, our local authority on Jamaican land-shells, taught me how to preserve these beauties in glycerine, when I could not convey them to him direct and alive. (Specimens shewn.*)

(*h.*) Such then were some of the diversions of my retirement and obscure professional occupations; but I never thought, for the first six years of my residence in St. John's that Geology was to add immensely to my intellectual resources and local recreations, in what seemed, to my untutored eyes, such an unattractive and unpromising district. I had indeed read (as we all do) many books and magazine articles about Geology, that are interesting enough, as a passing recreation, to the "general reader" (who is mostly, either a very tired or a very lazy animal;) but when I attempted to apply my discursive geological reading to the stratified or unconformable rocks and soils of Jamaica, I could make nothing of them, and was myself utterly at sea. Where were those †Azoic, Laurentian, Cambrian and Silurian rocks of the Primary era, on which all the rest were to be built up? Who would lead me into the Edom of Devonian Sandstones? Or to the Bozrah citadel of the newer Red? Alas!—Whither should I go to light upon the bones of Permian Saurians or Oolitic ptergodactyles?—What Geomancy or Rhabdomancy would aid me to tap the coal-measures of the Lower Carboniferous strata, or even the thinner and poorer ones of the upper Cretaceous series?

---

* All the specimens shewn at this lecture were selected from the various collections in the Jamaica Institute Museum.

† Rough Stratigraphical plans and diagrams exhibited, and here pointed out in sections as named.

"There was no open vision in those days." Woe was it to me! So that at last I threw up the whole thing in despair, not to say disgust; *for me,* geologically, Jamaica seemed all hopeless, from Dan to Beer-sheba, that is to say, from Holland Bay to Negril Point.

(*i.*) When, however, the Government Geological Survey of the Island was commenced (about 1860) the old desire returned. It belongs rather to my *second* head of this lecture than to my *first,* to say that we had had a mining fever in Jamaica some years before the time I had even attempted to study and locally to understand Geology; and perhaps it was, after all, desire for "filthy lucre,"—(some of my people had dabbled in Jamaica mining shares)—and not abstract love of science, that first set me, (years before,) to seek, on the ancestral acres, for "Sermons in stones."—However, be that as it may—long after the mining fever was over, but as soon as Messrs. Barrett & Sawkins, the Geological Surveyors, appointed to Jamaica, arrived, I sought and made their acquaintance, and got the latter of the two rather to anticipate an official visit to the district, and a private one to the Parsonage at Point Hill; and with him I re-visited all my local Tom Tiddler's grounds, and opened my mind to him freely about all my old local geological puzzles and perplexities. I lead Mr. Sawkins from valley and water-course to hill-side and mountain top, and slowly, and after many days, the problem and its solution were revealed to me. A door was opened to me (if not in heaven at least upon earth) and I learnt the Sesame or Shibboleth pass-words that could admit me through the portals, within which would be revealed the mysteries and glories beyond. A new sense was awakened within me, a new vision, that was also a *reality,* unfolded before me. Those frowning, weathered, high-upreared white limestones, (Mount Diablo for instance) were Upper Miocene or Post Pliocene —the nearer ones Lower Miocene and Upper Eocene, both, of course Tertiary. The clay—that nasty, sticky yellow clay! was fossiliferous Eocene, below the Miocene: being the *dawn* of the more recent stratifications lying above it. The Secondary (cretaceous) blue limestone (which last only crops up here and there in Jamaica) comes below the Eocene, but frequently trap-rock and conglomerate shales and sand-stones intervene between the Upper Tertiary and the Secondary formations (see Stratigraphical Maps of Jamaica shewn.) This Tertiary Eocene clay then is full of tokens of the conchoidal marine life of long ages past, tens of thousands and perhaps hundreds of thousands or even a million years ago; but these delicate sea-shells have been more perfectly preserved by the clay, than the most skilful Egyptian embalmers could have achieved to conserve for ages the bodies of defunct royalties. Generally, but not always, below this Eocene clay and its boulders come, in this Island, at once, either the true "conglomerates" or the metamorphic or eruptive or at least intrusive and more crystalline and igneous rocks; often, however, more or less superficially dislocated or disintegrated. Of the Eocene clay, I may say, at once, that probably something very like it, (fossils and all,) is now forming in the shallow yellow sea of China; that is with minor differences and modifications; for instance, an Eocene echinus is differently ribbed to a modern one. (Show the specimens of both on the table.) As the fable tells us that a mouse may help a lion, so I felt very glad upon a day when I took Mr. Sawkins into a terrible clay-hole on an off-road, where I had often floundered in *two* senses, and shewed him how I had got some delicate and perfect sea-shells, as I even then knew them to be, (although the present attitude is 2,000 feet above sea level, of the spot where they were found,) and also a handful of what looked like fossil millet or coriander seed.* And Mr. Sawkins was able then and there to settle that these last were Eocene foraminifera, and that the key of Jamaica's stratified Geology had been found by us in that clay-bed. Although I am not now lecturing on the *Science* of Geology at large, but only on that fragment of it which concerns Jamaica; yet it is not out of place to remind those who know, and to inform those who do *not*, that geological stratification only gives us the *leaves* of the book of the Earth's crust, but it is Palæontology (the study of the *older* fossils) that enables us to *page* the volume consecutively, and to read its letter-press; just as if it were an ancient and long-forgotten manuscript. Every fossil shell,—then,—every bone, every leaf or twig that we can identify, is a letter, a syllable or a logograph for us in this newest of languages, but oldest of writings. Now, although, I am not to-night to treat directly even of the palæontology of Jamaica, nevertheless, pardon me if I like to dwell for a minute or two upon these Eocene fossil-shells, which were the alphabet and monosyllables in my primer and horn-book of Jamaican Geology studied by me five and twenty years ago.† Look at them more closely Here is a Strombus, (shew,) a Conus, (shew,) a Solarium, a Murex, a Venus, a Cardita, (so called because the two valves closed, and looked at towards the junction form a heart, as if you were to bisect the ace of hearts vertically,) and here is a fragile, yet all but perfect, delicate little Pecten, a comb, or as we might fancy it a *fan* shell, (although the "pinna"* better answers to that name.) This pecten I am holding in my hand is certainly 50,000, and probably 100,000 years old. Some Geologists would extend its age to a million years, but as yet we have no *exact* standards of time in Geology, *but they may come*; as in Astronomy, for a long period all distances and magnitudes were *relative* not *actual*, but the study of transits of Venus, and some other delicate mathematical applications of the movements of the exterior planets and their several satellites, now enable us, within very close limits, to measure the distances, and to determine the magnitudes and even to estimate the weights of most of the members of our solar system.

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* Samples shewn hastily on black card (secured by Canada balsaam) and small card box of loose grains.

† Shew again blackened cards with the finer fossils adhering, also tray of loose foraminifera, and also the larger specimens individually, thus.

(*j*.) Mr. Sawkins had previously confessed to me that the soil of Jamaica had been so disturbed, and the several strata so upheaved and sometimes contorted, or otherwise altered, and was consequently so irregular, that for some time the Government Geologists themselves were a little puzzled what to make of it. He told me, at once, after our discovery, that if he and his co-workers in the Jamaica survey could have been lead on the day they landed to that "Boggaty River" clay-hole, (It is not rightly named?) Many weeks of uncertain toil and fruitless quest would have been saved, and perhaps the life of Mr. Lucas Barrett, his colleague (whose mural tablet may be seen in Halfway-Tree Church) might have been spared; for it was very early in the survey, while in a diving dress in the bed of Kingston harbour, looking for these same foraminifera, and other palæontological indications that Mr. Barrett's life was lost; apparently from the carelessness, or inexperience, and inexpertness of his attendants, at the surface, or it may be from defects of the apparatus itself. In any case, however, Mr. Barrett became one more of the many martyrs to Science, whose *physical* gifts of value are ever bestowed, not on the individual, but on the race.

(*k*.) For the rest of my residence in the inland parish of St. John, local and general Geology was one of my chief, I may say quite my chief amusement at home and recreation abroad, and became a positive solace and sustainer to me in weariness, sickness and other adversity. I came to recognize the meaning of indications, of the very existence of which (although I had passed them weekly for some years) I had been utterly unconscious. When I visited other districts I, at last, (more or less readily) traced similarities with, and was able to note and shade off differences from, what I knew and had studied nearer home. There are some fossiliferous blocks of Eocene (yellow) Limestone, &c., in the Museum department of the Jamaica Institute (downstairs) that I never pass now, and look at, without something like a feeling of old friendship coming over me, I knew them well, by sight, before I really knew *what* they were; as it is, indeed, with all of us, in regard to our mere acquaintances, before they pass into the circle of our intimacy. But this remark is clearly a digression, and I have no time to digress.

---

* From penna, a feather.

(*l.*) For some years past, then, I have read and thought over, and obtained and observed all I could get hold of, bearing possibly on the Geology of Jamaica. (It still amounts, alas! to very little.) Although for myself alone I should be almost sufficiently satisfied with the educational and intellectual benefits of the study; yet I have not been altogether unmindful of more practical and utilitarian ends, to which the local application of the Science of Geology may be eventually put, for the benefit of the inhabitants of this Island. It has been said that all beauty is in the long run only fineness of Truth. "The truth of accuracy and the truth of expression;" and at any rate and after all, in *this* world, *that* is only Right which leads to Truth and *that* is only Beauty which converges to *Utility.* I would wish, then, without having *one less* first-class cricket-team—one less bicycle-expert, or salt water yacht's-man, —without one less (indeed with a few *more*) chess tournament champions, Island scholarship-holders and Cambridge Local prizemen—yes, and prize-women too! I say, I wish, I could induce a few of our youths, of either sex, to turn their attention to Geology as a pastime, and I am sure they would soon make it a study, a new specialty for our class-rooms, as well as a new diversion for our holidays, and then, even in Jamaica *every* where and *any* where they would find both instruction and amusement.

(*m.*) Let our railway-clerks and station masters, our land-surveyors and road-wardens, become experimental Geologists. Let our planters and penkeepers, while they "keep the green side of their fertile fields uppermost," both on their lands, and in their minds; yet have an eye open to *all* that is already at the surface, and even (as opportunity offers) let them try to get a peep at what is below the soil, whether agriculturally fertile or barren. The Scotch minister told his son not to *seek* to marry for money; but to go and look out for "a gude wife amang weel-to-do-folk—Dinna wed for siller, Sandy lad, but gae where siller is!" So don't let us all to-morrow morning race off and prospect for coal or gold; but let us be ever alive to the indications and manifestations that Nature plentifully gives to us, both as to what to follow and what to shun.

Subsoil steam-ploughing for drainage and better annual crops—clearings made and deep holes dug in the interests of Arboriculture and Forestry must have their legitimate and natural effects and returns, and may also, occasionally, give glimpses of the unknown, (and in Jamaica much is still geologically unknown) which may one day bring fulfilment (long delayed) to the hopes of even a too sanguine Macawber, and gladden the heart and reward the stolid, but steady labour of a bovine Theban or witless Cappadocian.

(*n.*) For myself, when I think of all the labour and time, treasure and blood that have been, and still are spent and wasted on war; or even when I remind me of all the books that men have written, each author believing, and often asserting that he is putting forth the last and best word that can now, or will hereafter be said on his specialty—I say—when I think of these, and like things, why! I conclude that ordinary men, of strong bodies and good appetites, with sufficient clothing to cover the former, and food enough to satisfy the latter, might be FAR WORSE employed, all their lives long, than in the apparently Sisyphian* labour of just digging holes in the ground AND FILLING THEM UP AGAIN!!

(*o.*) In bringing my first division to a close, suffer me to make quotation from an author, on whom in my geological note-book, I have levied contributions, and I select one whose remarks are pertinent enough, but they have not yet found their way into the ordinary common place books. Marcus Antoninus in his XIth book of Maxims (sec. 17) says—"Consider whence each thing is come, and of what it consists, and into what it changes, and what kind of a thing it will be, when it has changed;" and again (or previously) in Book IIIrd, sec. 11, speaking (as it seems to me) just on this very point before us now, of the intellectual use of natural and material appliances, he says (I quote from Long's translation) "Make to thyself a definition or description of the thing which is presented to thee, so as to see distinctly what kind of a thing it is, in its substance, in its nudity, in its complete entirety, and tell thyself its proper-name and the names of the things of which it has been compounded, and into which it will be resolved. For nothing is so productive of elevation of mind, as to be able to examine methodically and truly every object which is presented to thee in life, and always to look at things so as to see at the same time what kind of Universe *this* is, and what kind of use everything performs in it, and what value everything has in reference to the *whole, and what in reference to* MAN."

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* For the quantity of this word, see Pope's Odyssey lib. XI., line 734; but I *have* seen Sisyphean.

Part 2nd—SPECULATIVE—SECTION (*a.*)—Under the head of *Speculative* Geology, let me say a few words (they shall be as few as possible) upon the tentative or experimental mining, that has been already in the past, or may hereafter be attempted in Jamaica. When I commenced to prepare my notes for this lecture, I had indeed intended, under this second head to epitomise a great deal of information and detail which I have for many years past collected, bearing on the questions of the relative wealth, or actual poverty of this Island, as to metallic deposits and resources; also pertaining to the history of past mining speculations and adventures made here; as well as in regard to the utility of attempting any such in future, or on the other hand, whether it would be better to continue—as at present—to let such enterprises severely alone.

(*b.*) After several attempts to concentrate my gatherings on these several points (and indeed they hang together—may be discriminated, but cannot be separated) I found—unless I desiccated them of all literary interest and compressed them—as it were—into the tables of a prices-current, or the columns of a Museum catalogue, or otherwise—threw them into such elliptical and Delphic sentences, that they would be utterly vague, and ambiguous; or else, on the other hand, perfectly arbitrary and dogmatic:—I found (I say) that the mere outlines of the evidence and summing up—on which I would ask you, as a jury to consider and pronounce a verdict—would far exceed the space I could give to the second out of *four* divisions into which my lecture this evening, will be distributed. I have, therefore, reluctantly, but of necessity had to cut out all details in regard to mining, and must only treat very generally and very briefly on local speculative Geology. Hence I have wholly excluded *metals*, proper, from the specimens of rocks and earths on the table before me. I still think, however, and I believe you will agree with me, that I could not have undertaken to give a lecture on the Geology of Jamaica, without somewhere and somehow alluding to the metallic indications (be they rich or poor,) which we undoubtedly possess in some of our surface soils, and exposed, denuded, and upheaved substrata, and other interior formations.

(*c.*) To some here present, for me to have made this total omission of metallic and mining references, would be very like a representation of the play of Hamlet, with the part and character of Hamlet left out, and I fear, for this class, even the little I can now say on mining, will seem, on my part, very like the conduct of that wise-fool—(the Scholasticus of Hierocles,)—who wishing to self his house carried about a *brick* as a sample of it! However *that* may be, all I desire, at present, is to get our chairman, with your consent to permit "a case to be stated," (as the lawyers say,) on "Mining in Jamaica," to be argued before you on another occasion, either by myself, (if to-night I can secure your interest and confidence,) or by some more generally competent and locally experienced and popular lecturer.* All I would now attempt, then, is to desire you to consider whether perhaps the pendulum of public opinion has not in regard to an equilibrium and stability of judgment on mining matters in Jamaica, now swung quite far enough in the negative and pessimistic direction? And whether also it may not perhaps be time for us to be a *little,* if only a little more hopeful and enterprising, and a little less incredulous and despairing, as to the possibility of turning our native metals—(if we have any worth being so called,) and at least our other minerals to account?

(*d.*) When I come to treat (as I soon shall) of my third head, that of Economic Geology, I shall have to state something of *known* and *certain* appliances of practical modern science and organized industrial enterprise, which can be utilized *here* in Jamaica, as they have been, and are being utilized elsewhere, to turn various sorts of inorganic materials, to be found on or in the earth, into *money's worth,* without first passing their elements through the natural alchemy and alembics of the vegetable or animal kingdoms; thus to be transformed into luxuriant crops, or lactiferous herds and lanigerous flocks. I shall also under my fourth and last division—that of Geology locally considered as a Science—have to say a few things, which will indirectly bear upon, or afford sidelights, by which hereafter this delicate and at present dubious (not to say dangerous) subject of Speculative local Geology may more clearly, calmly, and critically, but also, perhaps, with more hope practically, and more inducement financially, be considered.

(*e.*) In regard to the future (if at all possible) development of our mineral resources, I have now only a few general remarks to make. My chief point at present is that a fundamental axiom, in this matter must be, "*Sine geologiâ salus est nulla.*" The study of Geology will be the best *preventative,* and by no means a provocator of wild-cat mining schemes, and as I have already hinted, will have in it subtle pleasures and subjective profits which the share-market does not enhance or diminish, and which the stockbroker neither gives nor takes away!

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* The lecture here hinted at was duly given a month after, and also under the auspices of the Governors of the Jamaica Institute.

(*f.*) We are now in the re-actionary and incredulous stage in regard to a belief in local mineral wealth; but the colder the present apathy becomes, and the longer the lethargy continues, so much more marked and violent, impulsive and unreasonable will the action and excitement be, when they *do* come; as, one day or other, near or remote, they will assuredly come. And then we shall have the "old play" acted all over again, the actors indeed, and perhaps the stage may be different, but the drama will be the same, and the scenes and incidents of the situation will be identical. There will be the same wild speculation, the same ignorant assumptions and audacious adventure; the same sharp manipulation of share-scrip—quite as much in England and in America as here —the same extravagance of management and jobbery in supplies and appliances— far more so in England and America in regard to our future mines than here; and these are the things, in the past, that have been at least *three*-fourths of the causes of the failure of mining in Jamaica; much more so, indeed, than the poverty of our mineral lodes, even in Tertiary and Secondary stratifications or the Puck and Caliban antics and malevolencies of our metallic veins and leads in porphyritic dykes, and other intrusive and eruptive formations.

(*g*) As this head of Speculative Geology would be still more elliptical and unsatisfactory, without at least naming the metals, which have been found in Jamaica in a pure or mixed state, I will now supply my museum catalogue of them, utilizing (as much as space and time will permit me) the Report of the Government Geological Surveyors published in 1869.

(*h*) And I will now leave it, (as the Report very properly does, since it was not drawn up as a mining Company Prospectus,) an open and *speculative* question as to whether any of these metals occur in sufficient quantity and under conditions of sufficient facility to make it worth while to invest capital and expend energy, labour and skill in mining for them.

(*i.*) It can then be shewn that *Gold* has been found in modern times in the Clarendon mines (Stamford Hill and Charing Cross) from 2ozs. up to 15 oz. per ton! The 15 ozs. per ton is a far higher yield than the average given by gold mines in California and Australia, and the 2ozs. per ton pay very well, in those countries, when combined with other useful minerals, and metals, as was the case in Jamaica. But picked specimens are *one* thing, and ordinary samples *another*. Mr. Sawkins, however, told me that he thought a good working average of 2 oz. (per ton) of gold might be got from the above-named mines, and that the copper deposits

—although mostly carbonates and sulphurets—with which the gold was associated, were decidedly (under ordinary circumstances) well worth working, for their own value, without any reference to the gold.

(*j.*) We have silver in combination with lead, and galena or sulphuret of lead; these minerals have been found and worked at Hope in St. Andrew, and also at Thomasfield in St. George's, and have been found, but not worked in Metcalfe. Previous attempts, however, to make these indications pay have failed, and geologically, they are not promisingly situated, and until new finds occur had better be left alone.

(*k.*) We have abundant surface and under-ground indications of copper* assuming different characters and widely diffused over the Island. Portland, Metcalfe, Upper St. Andrew, Port Royal Mountains and Clarendon may be mentioned, as the more promising districts, as far as is yet known.

(*l.*) At Bloxburgh, in the Port Royal Mountains, Cobalt has been found and workings have been attempted; but the occurrence of this metal, to this time, only seems to be small in extent and of little value or promise of importance.

(*m.*) Zinc also occurs in combination with the lead and silver at the Old Hope mine, also at Salisbury plains in St. Andrew; but appears hitherto to possess little promise of value or quantity.

(*n.*) The oxide (or di-oxide) of Manganese, called pyrolucite —occurs—rather profusely at Marshall's Hall in Portland, and I believe it has been found elsewhere; and submitted to chemical analysis. It is worth from £4 to £8 per ton in England and at the former price would now pay well, if it could be got at in *quantity*, and under easy geological and physical conditions. (See Part III. "Economic.")

(*o.*) We have a great deal of superficial, nodular, magnetic, micacious and oxidized iron, especially in the county of Surrey, the least stratified part of the Island. Iron is chiefly or really the colouring matter, chemically, of nearly all our red and brown soils, stratified or not. Porphyry (red and grey) however, has I believe, except perhaps in intrusive or deposited veins, little or no iron in it (mostly felspar,) and indeed we have to this time no indications of regular beds of *iron-stone*, which could alone be steadily depended upon to give constant supplies of material to blast furnaces, which might be set up even in Jamaica, at least, for copper-smelting, if the ores and the fluxes and the necessary fuel could economically be brought together.* We have abundance of wood for this purpose and Swedish iron is *naturally* the best, because it is smelted with wood and not with pit-coal.

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* See subsequent lecture on "Mining in Jamaica."

(*p*.) But here I am passing from Speculative to Economic Geology and Metallurgy, and must for the present return. We have arsenical pyrites at Friendship in St. John's, and at Salisbury Plain; but this composite ore did not seem to the Surveyors of much value. I may here say, however, that if springs be impregnated from this mineral they may have a special therapeutic and tonic effect in certain cases of fever and marasmus; but on the other hand, they may occasionally and under special circumstances, either *subjective* or *objective*, or both, cause accidental poisonings; even when not habitually prone to these disastrous results. But I am again getting beforehand to Economics. On the subject of pyrites, then, generally, I may have a word or two to say under my IIIrd. head, (see sections *k* and *m*.) For the subject would better come under, and could only be sufficiently treated, as a matter of economic utility, or, better still, of practical and scientific metallurgy.† But to-night I can say little about it.

(*q*.) Antimony has been met with up the Morant River, but the precise location of this mineral deposit has yet to be found—has not yet I believe—been even *sought* for.

(*r*.) I will close the present list of Jamaican metals with what I believe to be an authenticated fact, although it is not mentioned by the Government Geologists in their Report, and is ignored in most or all *modern* works on Geology and Mineral Chemistry; but it duly appears in all the *older* text-books which I have been able to see and search. And it is a sound principle in scholastic criticism that the older a tradition is, the more likely is the base of it to be authentic and credible, *i.e.*, the nearer the springhead it can be drawn, the purer the water is likely to be. Ecclesiastically a *second* century tradition is worth more than double one of the *fourth* century, and one of the *third* is worth more than *four*-times as much as one of the *sixth*, and so onwards. My attention was first called to the statement I am going to make, by my friend, Thos. Harrison, Esq.,the Crown Surveyor, and the statement is this : The first specimen known—(known at least in Europe)—of the metal platinum was found in *Jamaica*, and brought to England by a Mr. Wood, in A.D. 1741, less than 150 years ago. Will some one, through the Public Records Office, or otherwise, trace out this Mr. Wood and let us know something more of him, and of any landed property he owned or managed in Jamaica? Platinum is heavier, and nearly or quite as valuable as gold, more so for strictly scientific ends; and like gold is generally found pure and native, chiefly in grains, but sometimes in an amorphous state.

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* See part III sects. *k* and *m*, and also lecture on Mining in Jamaica, (Prospects) IV., section *t*.

† See part III sects. *k* and *m*, and also "Mining in Jamaica," (Prospects) IV. section *t*.

(*s*.) And as far as *metals* proper in Jamaica are concerned, I believe, that is about *all* at present known; and you may think that it does not come to *much*. *Let it be so for a while*—I am content—and also I am conscious that I stand here to-night, as far as *Speculative* Geology in Jamaica is concerned, as an *Advocatus diaboli*, although I am further damning my client—(in the judgment of some, doubtless) with faint praise. Perhaps, for the present, it is better so. Still I would say, as a last word, now, on this second division of my subject, that judicious mining is as safe and profitable an investment and pursuit on the *whole* (for rich people at least) as any other speculation—" Ginger will be hot in the mouth"--and speculation—of its very nature—*must* be *speculative*!*

Part 3rd.—ECONOMIC—SECTION (*a*.)—You have permitted me, *first* to carry you through the lower air of a part of the simpler metaphysics; *secondly*, I have piloted you rapidly and noiselessly, (lest we should wake the Sirens' song and be captivated) over the narrow but unsurveyed, (and therefore doubly dangerous) sea of Geologic speculation. We now touch bottom, and reach land at last, in coming, *thirdly*, to consider *Economic* Geology; but it is a wide and varied land, and I shall therefore only attempt just to indicate the outline, and make a few traverses over this surer, but still for us in Jamaica, almost untravelled ground.

(*b*.) Economic Geology,—I must just say (more with a view to local application than merely for exact didactic definition) is that branch of the science which enables us to see and to say to what uses our various metallic ores, earths, and rocks can be put, by art and industry, namely, either by merely manual and mechanical labour and appliances, or by our being able clearly to detect the less obvious, but more valuable constituents, that may be extracted and obtained from the earth by manufacturing and scientific processes Art has been defined as "Nature plus the ingenuity of Man." Geology is therefore closely allied to Chemistry. A man may be an excellent chemist, without being anything of a geologist; but it is impossible to be a *skilful* geologist without, at least a sufficient knowledge of Chemistry. As I have already acknowledged that I am a sorry geologist, so I now likewise confess that I am still worse as a chemist. However, all the the actual information I need at present convey on the Economic Geology of Jamaica connected with Chemistry, comes readily to me at second hand. But Economic Geology, as its very attribute, implies other conditions, *many* other conditions, as well as a knowledge, or at least a utilization of Chemistry. There must be no speculation, at least as little as possible about it. It must be regarded as practical more than theoretic, or even than scientific; as quarring rather than mining work, and *quantity*, rather more even than quality is to be *first* looked to; unless indeed the quality be absolutely worthless, and there is nothing on earth (save a man here and there) that *is* utterly worthless. This holds good even in regard to metallic lodes, a poor lode—if broad and level, regular and constant, will in the long run, pay better than a rich vein, that alternates between "bunches" and "faults" and "breaks," "strings," and "pockets," and is always changing its vertical and horizontal angles and "dips." Again, as the crude terrestial materials to which Economic Geology is to be applied are generally bulky and heavy, and also usually found far from the manufacturing centres, where they can be scientifically treated and utilized; *cheapness* of transit is a *sine qua non*, in nine cases out of ten, whether it be best, or not, to quarry such minerals. To these requisites I should perhaps add, *locally*—enterprising capitalists and an industrial peasantry and—*generally*—advanced science and technical skill.

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* See Lecture on Mining, part IV., sections *i*, *j*, *k*, *l*, and *t*.

(*c*.) I have carefully read all the debates in the Legislative Council, the newspaper articles and published letters I could get hold of, including Reports of Commissioners and Government Surveyors or Officers of the Public Works department, on the question of railway extension: which for the last two years has been a great subject of public attention and discussion in Jamaica; and it exemplifies and illustrates what I have already said about the present torpor of the public mind, as to any regard for our mineral resources—that (as as far I know) to this time, no one has cared to consider for a moment, the effect of railway extension from the stand-point of Economic Geology, and the clear advantage it will be as a factor towards the success and profit of railways, if haulage and freight of minerals can be made to take an important place in the traffic returns. At any rate—*quantum valeat*—I now make the promoters of railway extension, a present of this idea, and call their special attention to, and invite their aid in developing and utilizing it.

(*d*) So far then, for the theoretic (but mark you not *speculative*) aspects of the matter; let us now come to the practical details, as far as I can, in the time at my disposal, treat of them.

(*e*.) The consideration of soils, in regard to the crops they would naturally or may be made artificially to bear, comes rather under the province of Agriculture than of Geology, and so I shall not meddle with that matter directly, but indirectly I may say that many of our clays, marls, &c., are excellent ameliorators of poor or subborn soils, and if chemically analyzed, some of them might prove rich in nitrates and phosphates, which would go far to dispense with the need of imported manures for cane or coffee cultivation, &c.* And limestone, of which *five-eighths*† of Jamaica are superficially composed—limestone is the very material out of which Nature has chosen (emblematically, I'm sure) to carve her cornu-copia; although as a building material it is, both in its natural and in its calcined condition of little less value to mankind. Just let me give a practical illustration of what might be done with our limestones in the Long Mountain or at Stoney Hill, If tramways were run up to Rock Fort, and also to the old Hope toll-gate, (there is a tramway already to the foot of Stoney Hill and the Car Company is utilizing the quarries there,) limestone blocks might be easily brought to Kingston for building purposes and causeway-making; and the fragments used for concrete works and street repairs and reconstruction of our city generally; turning it from a square of imported match-boxes into a quadrilateral of native stone. Strongly built lime kilns ought to be kept going on proper sites all the year round, and lime in Kingston for building and sanitary purposes should be as cheap and plentiful as it is, now dear and scarce. The Long Mountain used to supply most of the fuel used in Kingston, before the railway was made, and is now wooded sufficiently to feed for many years (until better and cheaper motive power can be got,‡ which is sure to be the case before the Long Mountain could be denuded of fuel) to feed I say, a 10 horse-power engine at the Hope road quarry which would drive a stone-cutting machine, to shape the limestone blocks into squares and parallelopipeds, and to crack the fragments into suburban road dressing, and to crush and stamp the very residue, remnants and sweepings into flour or powder. And as the tract is all down hill, break-appliances rather than *motive* power would be needed for cars laden with these materials. This limestone flour, (if it it could be got readily, and not at prohibitory prices) would be just the top-dressing we want on our impoverished pasture lands in Liguanea: it would thus add to the quantity and improve the quality of our milk supply, sweeten and fatten our mutton, and do a great deal to get rid of "guinea-hen weed" and "devil's bit"—which are now over-running our more shaded and richer pastures; and might also give our succulent grasses, in our open commons, some chance of surviving the inroads of sour, wire, and foxtail grass, also of "yellow-flower."* This last is commonly known as "kill buchra" as it flowers profusely immediately after the season rains, which are known to promote the development of yellow fever in unacclimated "white-folks." (The old "post hoc, ergo, proper hoc"; once more)—so the yellow flower is supposed to *cause* yellow fever. It does not do *that*; but nevertheless it ought to be called "kill pen-keeper", as it starves most sorts of stock, save indeed poultry, especially turkeys, which like and fatten well on its flowers. This weed-pest in St. Andrew (I own) is a sore and personal matter with me, for in that district I am interested in "*three acres and a cow!*"

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* The beet root grower always sends samples of his soils to an analytical chemist, who advises what to supply to the land to increase the growth and saccharine productiveness of the next crop.

† See Part IV, section *e*.

‡ See Part III sections *t* and *u* of this lecture

(*f*) I don't know whether you will allow me to consider "bat's manure" as a geological production; but it is closely connected with the numerous caverns in our Tertiary limestones, and I could prove that it is worth to canefields as much as sulphate of ammonia, and will fetch, if exported, as much as that artificial manure in the English markets. A good deal is known to exist in Jamaica, *some* has been locally utilized, more has been exported and carried to America; but very much more must remain, to be found by accident or search, and it is being formed and added to daily in all our caves, and many of these are already well-known, and are more or less accessible.

(*g*.) Of our mineral waters, I shall here say nothing more than by way of allusion and reference: for they have already been ably and sufficiently treated of in a previous lecture before the Institute of Jamaica, given by one of its governors, the Hon. Dr. Phillippo; as far as regards their therapeutic or medicinal value; and it would come rather under the head of the applications of local metallic and mineral Chemistry, than of Geology proper, (and therefore both beyond my present purpose and general competence) to treat of the constituents of these medicative waters, as far as their metallic or mineral elements may possibly be scientifically eliminated and applied to *Economic* purposes.*

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* Turkey bloom—Caltrops or Tribulus from the nature of its spiny seed capsules.

(*h.*) Jamaica is rich in road materials, despite upland stretches of sticky red, blue and yellow clay, and lowland hollows of saponaceous alluvium, (which last is a euphuism for downright mud); nor are our building stones confined to limestones, Tertiary or Secondary. "Few countries (I am here quoting the Geological Report) are better supplied with this material (*i.e.* building-stone) which varies in degree from the finest marble to coarse but enduring sandstones"†—Of the former (that is the marbles) I may say—parenthetically—that we have them of all colours and shades, black and blue, green, red and white, and if you include Eocene orbitoidal limestone, *yellow* also , and we have them of all grades of granulation and crystallization, nearly—if not quite—up to the purity of Pentellic, Parian and Carrara standards. "The marbles" (to continue the quotation) "are abundant along the southern base of the central chain of the eastern mountains, and form a zone extending from Plantain Garden district to the heads of the Green River in St. David's." "Sandstones, possessing the property of free-stones, that is, to be workable under the chisel into square blocks" (The Report really becomes enthusiastic here—and rightly so—about the *squareness* of those blocks) which it goes on to say, are to be found in abundance, mark you, *that* (as I have already shewn) is a strong point "to be found in *abundance,* near Serge "Island, (St. Thomas ye East); near Moore Town and Port Anto-"nio" (in Portland) "and at Smithville and Kelletts' in Clarendon." You should go, as I have been, to Kellett's in Clarendon, and also to Good Hope (in the Port Royal Mountains), and you would see what the old time sugar and coffee land-owners did in Jamaica, with our native building stones. You fancy you are passing beneath the ruined portcullis, or skirting the keep of the castle of some mediæval baron, rather than entering the approaches to the works and "great house" of a (so called) absentee Jamaica proprietor. To return, however, to the substance, if not always to the "letter" of the Report, (for stones are apt to be dull and dry at times). They have, then, again at Serge Island—(happy Serge Islanders! probably few of you know at present "where to find them"). They have at Serge Island, flagstones and freestones from a foot to three inches thick—(the thinner the better, economically).—When Bohemia gets that sea-coast which Shakespeare[*] has so royally given to it, and Serge Island in like manner becomes a commercial city and Caribbean sea-port; *then* will those flagstones prove of great local value to the Serge Islander. It would, however, at present take a ten mile tramway to get those flagstones to the barquedier; although sugars and bananas could go likewise; for at present Serge or *Sarge* Island is an upland sugar estate in the gorges of the Blue Mountain Valley. But we may get our flagstones, when we *do* pave our treets in Kingston, nearer than Serge Island; at Lloyds and Windsor Forest in St. David's, three or four miles from the sea-beach, they have durable laminated stone from one inch to three feet thick, and even these last may be split again and again, (almost like slates) "with a wooden wedge" (so say the Geological Surveyors, and they must know, I have not tried it myself). So also the Report says "On the "Morant and its tributary the White River, there are sandy beds "of dark carbonaceous shades, which would afford excellent pav-"ing stones"—and I may add mortuary tablets (now wholly imported) and slabs for markets, laundries, lavatories, dairies, and many other purposes of public or domestic use and ornamentation. But we have not all these good things at *this* end of the Island alone. Trelawney has flagstones at Good Hope "slabs seven or eight feet long" says the Report—again getting excited on contemplation of such lapideous treasures—"slabs seven and eight "feet long may be procured and in great abundance" (mark again the abundance, *that* factor goes a long way to counteract all possible drawbacks). "The only limit to production" continues the Report "consisting in the difficulties of labour and transport"—"Just so" you may say, "now that the British farmer is suffering from bad "harvests—from free-trade and foreign competition, Mr. Gladstone "bids him, try *jam*! the Trelawney sugar planters are battling "with beet-root bounties and Panama Canal labour competition, "and you—Mr. Lecturer—offer them *paving stones*!" "True," I reply, "however, even now, when bounties are being shaken "and loosened, nevertheless, it may yet be found more difficult to "dislodge and finally to remove the bounties than the paving "stones;" especially when the Panama Canal—either by successful completion, or by (already preluded) collapse, returns to us, most of our migrated over-lookers and steady labourers, who ought by their "Isthmian" experience to have become smart quarry-men and trolly drivers.

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* Perhaps some of these waters, when potable, the cold rather than the warm ones,—the saline, calcic and ferruginous, rather than the sulphurous, might be bottled for exportation, as is done largely in Europe with the waters of Vichy in France, Carlsbad in Bohemia, and Apollinaris; of the last, I see, by advertisement that nearly 12 millions of bottles were put up in 1887. Dr. Phillippo mentions that the Milk River water has been artificially aerated in Kingston by Mr. Paine, and kept for 12 months. This process when available, would add much to the flavour and freshness, even when it did not enhance the medicinal virtues of these bottled waters.

† Some of these sandstones would make fair grind-stones, and hones for axes cutlasses and pruning bills, and some are even fine and hard enough to be used for pen-knife and razor whetting.

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[*] See "Winter's Tale", Act III, Scene 3.

(*i.*) We have Porphyries, red and grey for polishing and ornaments; and porphyry, although naturally very hard, is in course of time disintegrated by atmospheric and pluvial action, and makes a rich loam. We also possess quatz-itic sands—(to make emery paper and scouring sand). We have alabaster (which is but glorified gypsum), ochres, red, white and yellow—and *abundantly*, we have them all! On the subject of these ochres the Report becomes (and justly so I think) both remonstrant and indignant. "It is surprising," it says, "that the inhabitants of the vicinity "should pay sixpence per pound for foreign material in place of "utilizing that which is deposited so extensively around them." Alas! such is also the case with many other minerals in Jamaica in addition to our ocherous deposits. Secondary or cretaceous blue (hippurite) limestone makes much better and purer lime than either coast or Miocene (white) or Eocene (yellow) limestone; but members of my flock in St. John's, living on the spurs of Juan-de-Bolas—(where this blue limestone here and there crops out), before and during my time—and I fear since—although latterly, after I myself—(as Mr. Campbell-Bannerman would say)—had found geological "salvation," I tried to cure them of the following heresy and mal-practice; nevertheless they continued to buy at Point Hill (where the white limestone begins to range) and carried in bags some four or five miles—all the lime they wanted, (over very steep and sticky roads) on the back of "a jackass"—bad for the poor "jackass", if there were no sound tarpauline to cover the lime, and if it came on to rain, as it does thereabouts, at least *once* a day, for 250 days in a year.

(*j.*) By the way we *can* and sometimes (though rarely) *do*, manufacture first-class bricks* of all sorts in Jamaica, and might probably open an export trade for them to Colon, Barbados, Antigua, &c., also for temper and stacked lime, together with our cattle, horses, and "bread-kind;" which last named, animal and vegetable productions are already in over-sea and steadily increasing demand; and perhaps with a little organization and negociation, it might be possible to arrange return freights; and colonists immigration might possibly be secured, of persons of colour, from the United States and from those smaller British West Indian Islands where population is already redundant and increase stationary.

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* In 1888 we *imported* these to the value of £747, and exported, nil. I think the Eocene clay would (if divested of grit and broken shells, &c.,) make a good modelling clay. I would like to try and make two *raised* maps of Jamaica for the coming (1891) Jamaica Exhibition; one topographical and the other geological. It will be a tough job; but if I could get this Eocene clay brought down from Point Hill to Kingston without too much expense, I would try some moulding experiments in that material. I have tried clay from the Penitentiary and Rae Town, but even after sieving and working and beating, it is too friable to set firmly without being mixed with glue, and then is otherwise unhandy.

(*k.*) We have all the elements for making cement, an important fact, considering how much of this material is already imported for Government works and private use.* And much more will be wanted if our railways are to be extended, and our various agricultural and manufacturing industries, thus invigorated and promoted. We have plenty of gypsum (sulphate of lime) and might manufacture our own plaster of paris; gypsum is also a valuable agricultural manure. We have all kinds of pottery-earths, including kaolin, so valued by the Chinese! and flints (silica) and we might make, not only as we now do, "yabbas" and water "monkeys"; but also good glazed delf, and perhaps bye and bye finer china and porcelain, or at least plaques, vases and floor-tiles (encaustic). We have sinter or tufa and travertine, so we might be independent of Barbados for drip-stones, and might even export these,—over local demands— to Colon—where they much need to filter the water drank there. We have all the elements for glass-manufacturing; indeed I have picked lumps of 3 or 4 ozs. of crude glass out of the stoke-hole ef Worthy Park Estate, which were formed from the union, under heat, of the potass in the trash-fuel and the silica in the cane-rind. But doubtless some will think it would be more "economical" in two senses, to search up all the old broken bottles in Jamaica and melt and mould *them* into new ones, rather than to use our native silica and potass, for glass-making.—Perhaps so—I am now but stating what *might be* done if only it *would pay* to do it. Flints, also, can be utilized (and possibly even old glass bottles) as a flux in copper smelting from pyrites, if we even get locally to this scientific process, as I have no doubt we shall.† We have Serpentine and jasper, and also agates and cornelians, also crude amethysts and probably garnets and topazes. Of other and more costly gems I am not myself sanguine; but I should like to pay a visit to the ruby mines of Burmah, or get an expert from those localities to over-haul some of our conglomerates and breccias. A queer rumour has recently come to me of a coolie-woman taking to a jeweller in Kingston a red transparent stone, to have a hole bored in it, to hang it round her neck. The jeweller, believing the stone to be of some value offered the woman any ornament or trinket in his store for it, and she went away, well contented with a heavy silver necklace and locket. It is next rumoured, (you will say that I am a dreadful old gossip), that the jeweller shipped the stone to Europe, where on being examined by an expert lapidary, it proved to be a fine ruby, and on being sold realized £1,800 (indeed some say £18,000 !) Now supposing there is the slightest truth in this story, which I doubt—and pray, understand that in any case I do not wish or intend to cast reflections upon the honesty and good faith of the jeweller—but, I say, supposing that there be any truth in this story, to the extent, at least, that a stone which turned out to be a ruby *was* swapped for a silver necklace, which was, or at that time appeared to all parties concerned as of about equal value; then I ask, *Where did that ruby come from?* Was it already cut and polished? And had it thus been brought from India by an immigrant as a charm or heirloom? If of *much* value had it been stolen in India and smuggled out of that country to be got rid of, even at a heavy discount on its value—when it could no longer be traced? Did the woman, who eventually parted with it, know of any of these probabilities; or was the stone still rough and uncut, and had she picked up that ruby, *in some water course, or on some hillside in Jamaica?* For some time after diamonds were first discovered at Kimberley in South Africa, one of the best places to find them was in the "wattle and dab" of the old Kaffir huts in that locality, and some very fine ones were used by Kaffir children as chuck-stones, before any one had any idea what they really were. A white stranger finding himself in that locality got one as a curiosity from a child for a shilling, and it was only when he returned to Cape Town that he found out that it was worth £5,000! Then of course there was a rush for the diamond diggings. We have at present no promise of diamonds in Jamaica, as we have no extinct craters of mud volcanoes in old stratifications; but in the interests of local Economic Geology, I should like to get to the bottom of this cock-and-a-bull, or rather hen-and-a-jewel story! Perhaps some local Wilkie Collins or Ryder Haggard will hereafter work it up—I mean this story—(true or false)—of the ruby—in a sensational novel.

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* I don't see this item in the 1888 Collector-General's Import Returns, or previously.

† See lecture on "Mining in Jamaica" IV (Prospects,) section *t*, and see Part II. section *o*, and Part III. section *m* of *this* lecture.

(*l.*) But let *us*, at least, now return to matters of fact that is to those utilitarian and therefore delightful paving-stones, which, with the help of the Geological Report, I have tried to press very much upon your present favourable notice and future patronage.

Efforts have been made, (chiefly by the late Edward Colton Lewis, Esq., to utilize these, or similar native and laminated stones for lithographic purposes; but this attempt has failed, as was geologically to be expected; (but we had no geology in those days in Jamaica, and little elsewhere.) The true lithographic stone belongs, I believe, to the Lias (middle secondary) or Permian, (upper primary) formations; (pointed out on stratigraphical maps) and we have as yet found none of these older stratifications in Jamaica, and are not likely to find them. To gather up the fragments of this section, I may say that we have some lignite, and our carbonaceous shales in Clarendon and St. David's, Westmoreland and Hanover deserve some attention, beyond their very high agricultural value; but as that would tempt me to speak of coal, I have relegated all that, with rock oil and natural gas, to the *suppressed* portions of my *speculative* division, for even therein I thought these subjects too inflammable and generally dangerous, for me, in my own safety to handle; as well as, out of regard for your present time and general interests, on this occasion, to meddle with.

(*m.*) And so in like manner, time, if even not caution, will not now permit me (as I wished to do*) to say anything more of the Economic value of iron and copper pyrites, if treated scientifically. In our old mining adventures these minerals, as far as they could be eliminated from the extracted ores, were pitched away as a positive nuisance. Miners are wiser now. It is no longer doing these substances simple justice to speak of them, under the ambiguous head of Speculative Geology, and so I said I would reserve what I had to say about them to this third and more certain part of my present address; but I now find that "pyrites" economically considered could only be dealt with under the consideration of future practical and remunerative mining in Jamaica † If copper mining be ever adventured again in Jamaica, (and I am sure it will be,) it is from our cupriferous pyrites even of low percentage of yield, that under modern scientific metallurgy, we may expect to get satisfactory, that is, *paying* results.

(*n.*) I have said in regard to Economic Geology that I would only touch the fringe of it, or (to speak otherwise) indicate but the outline of this extended ground, and really I have barely done even this. It is, however, time for me to close up this third, and proceed to the fourth and last division of my subject of to-night; but before I do so there is just one more semi-geological production which I cannot wholly pass over. I shall not treat of water applied directly and agriculturally, in regard either to upland forestry or lowland arboriculture, or at any length speak of water storage and irrigation, but rather confine myself to the aid Geology gives us for procuring supplies of water in superficially waterless districts, or in severe droughts.

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* Part II. Sec. *o*, III. *k*.

† See "Mining in Jamaica IV. (Prospects.)" Section *t*.

(*o.*) I shall also have no time either under this Economic division, nor yet under the scientific aspects of my subject, to say in detail anything of Artesian well-borings; for at present this most important matter, is, in Jamaica, quite as speculative a subject as Copper-mining; but in almost all other civilived countries—including Queensland—the Governments of them, respectively, are making liberal, but wise expenditure in scientific well-boring, for water, petroleum, and natural gas.

(*p.*) I can only speak of more superficial indications that may be made use of for tapping water-bearing strata; when, then I come upon a thick yellowish (Eocene) fossil oyster shell, (shew specimen) on a thirsty upland plain, fringed with limestone mountains—for instance about Look-out and Ludlow in Upper Clarendon, where they are sometimes sorely stricken with drought, and such fossil shells I have myself found on the road there; I know that a well of 20, 30, or at most 40 feet deep would probably tap a perennial and copious supply of clear and sweet water, where there are, at present, only small tanks and muddy ponds to supply both man and beast. In Dr. Phillippo's lecture on the mineral waters of Jamaica, to which I have already alluded, there is this passage, which, being short, I extract—"I have been told by our late Government Geologist, Mr. Sawkins, of several districts, thickly inhabited, in the neighbourhood of which were underground rivulets, which he could hear rushing beneath the soil, and which needed but a few feet of excavation in order to satisfy the thirst of those who in dry weather, were almost perishing from a lack of water." This statement of hearing the "subterranean rushing waters," may seem to some, (what the Yankees call) *rather steep*; but from my knowledge of Mr. Sawkins' character and professional exactitude, as well as from the general facts and truths he was alluding to, I can accept the above statement as literally true.

(*q.*) To show what might have been found and utilized long ago, if Economic Geology were a little more cared for, studied and applied in the West Indies, than has heretofore been the case, I will adduce a valuable source of water that has recently been found in Barbados. The great and increasing want of that fertile and densely populated sugar island *is water*, and this is ordinarily supplied from deep wells, but this supply is threatening to fail, and in not a few cases has wholly failed; every new and deeper well sunk, draws and drains all those less deep within an irregular circuit around it; but in boring a well a short time ago, (see *West Indian Quarterly*, vol. i. No. 4, page 405—"Argosy" Office, Demerara,) which well it was necessary to drive down more than 200 feet; a subterranean and copious supply of running water, hitherto undreamt of, was discovered in a cavern pierced at that depth at Bowmanston. This underground stream, although hard to get at, has been tested and is estimated to yield *five millions* of gallons daily in wet, and even *two* millions daily in dry weather. The reservoirs at Hope, St. Andrew, Jamaica, which, until recently, supplied our city of Kingston, and the whole plain of Liguanea with all the water they obtained, do not, I believe, receive and store more than *two* millions of gallons per day, less than two days consumption. The altitude of this underground stream in Barbados, is 400 feet above sea level, and efforts are being made to utilize it—(by levelling and tunnelling or by pumping) for economic purposes—both motive power and irrigation. The spring-head in the cavern may probably be traced up much higher. Mount Hillaby, (the highest point in Barbados) is 1,145 feet in elevation, little more than *two-thirds* of our Long Mountain to the East of Kingston; from which last, being Miocene limestone, under-laid by Eocene clay, some water gathering might perhaps be obtained for places near there, on the plain, which the present service by pipes from Hope, can hardly sufficiently supply. I have indeed heard of one or two small but constant springs in this locality. There are also old wells, some still in use, at most of the pens on the Long Mountain Road and several springs do burst forth from the foot of the Long Mountain, all the way from Breezy Castle and Myrtle Bank, Kingston, to Rock Fort. The old wells of Kingston used to give in the upper part of the town, and in the driest weather, sweet and abundant supplies of water, shewing that they were fed from deep seated sources or from higher levels.*

(*r.*) But it is of water as a natural dynamical agent, that I will now only further speak. The height of our mountain springs and rivers above sea-level gives us a natural and cheap, but a wonderful and constant source of latent hydraulic power, or potential energy, by which we might get even our city church organs blown, as they do in America, and is indeed suggested by the very first meaning and use of "hydraulics" by the old Greeks. It was the hilly nature and many springs, with consequent water-power, which first made Lancashire the seat of the expansion of the British spinning and weaving industry; and indeed the altitude of the sources of all our rivers, may one day, (not now too distant) be to us in Jamaica a source of power and wealth, more enduring, if not in actual or proportional amount as valuable to us locally, as her coal-fields have hitherto proved to be to Great Britain. Our old time planters too, before steam was used as a motive power, well knew how to turn our water resources to account. I know three abandoned sugar-estates up a northside valley. There is a little stream in that vale, and its expansions, that rivulet at present is vagrant, and your horse has now to bend his head to his fetlocks, to get a sip of the cool upland waters, coming down through the wooded plain, but I remember when that little stream used to fill a long aqueduct, and so turned in succession the powerful mills of those three once flourishing estates. Wind-mills were never so extensively used in old times in Jamaica, (although there were a few) as these still are in the Windward and Leeward West Indian Islands; because, although our sea and land breezes are at least as strong and constant as the prevalent trade winds are in those islands; yet there are very few localities in Jamaica where wind-mills were a necessity, for mechanical power, from the absence of sufficient fall or volume of water to drive overshot, or even undershot water wheels.

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* In a series of unsigned articles published in the *Gleaner* newspaper of this city, in May and June 1882, during a severe drought; I set forth the above, and some other and better opportunities and facilities we have for utilizing our many natural sources of water supply in the neighbourhood of Kingston. I also at the same time advocated (I had no personal interest, direct or indirect in doing so, nor was I influenced thereto by others) that the Constant Spring tunnel waters should be secured for the use and aid of Kingston against drought and other increasing drawbacks of the Hope Valley, which plan has since been adoptod by the Government, and is now in efficient operation.

(*s.*) It was the utilization of the power of sufficient quantity of falling water which at once drove the drills and forced air into the workings, by which process it was possible to make the five and seven miles long tunnels of Mont Cenis and St. Gothard between France and Italy and France and Switzerland respectively, and perhaps some such use of our water-power will one day be available and advisable here, in working out long tunnels in our proposed railway extensions.

(*t.*) I have just one more economic use of water to bring to your notice. My knowledge of practical Electricity is less even than my knowledge of Chemistry; or I might more correctly say, my ignorance of the former is still greater than my admitted innocence of the latter; yet I believe I am not speaking altogether wildly or idiotically, when I say that in our mountain cascades and upland river rapids, within 10 or 15 miles of this city, we have a subtle, but willing and waiting power that might "without haste" and yet "without rest," be made to work electric-motors, rotate upland and lowland "dynamos", (connected together by aerial or subterranean conducting cables) and also charge stationary and movable accumulators; so that we might have our electricity laid on to every first class dwelling in Kingston, just as we have our water and gas pipe supplies, indeed we could then do away with gas lamps, save as a *pis aller*, and at cheaper rates than at present, make by night our streets, and even our lanes, brilliant with light. I learn, for instance, that a dynamo placed in a mill at one portion of the edge of the Falls of Niagara, is to-day utilized for supplying Electricity to many cities or towns in its vicinity, including even the city of Buffalo, 26 miles off. (*W.I. Quarterly*, Vol. II. No. 1, page 87).* By the same electrical appliances, limited in action only by the all but exhaustless water agency in our adjacent hills, we might get mechanical power sufficient (without the nuisance of smoke, or the danger of fire from chimney-sparks) to drive all our stationary engines in Kingston, thus saving the importation of fuel, or its local transportation, as now required—and indeed it would not be impossible by the same means to run our harbour ferry-boats, and pleasure-launches; and even to work our tram-cars also, *i.e.*, by Electricity, if found cheaper and more convenient than mule-power; although I myself have much faith in the traction virtue and stamina, as well as experimental belief in the kicking capacity of the average Jamaica mule.

(*u.*) The day of the steam engine is probably drawing to a close. It wastes too large a percentage of the power it is intended to generate and utilize. Sir Frederick Bramwell, the President of the recent meeting at Bath of the British Association, told his audience that "we had passed the age of Steam, and had entered "upon the age of Electricity" "and that" unless some substantive "improvements, at present unthought of, were made in the steam "engine—the year 1931" (that is, the centenary of the British Association), "would see the present steam engines in museums, "treated as things to be respected, and of antiquarian interest to the engineers of those days," and (speaking of gas and vaporized alcohol, and other spirits as direct, motive powers) he considered that he was "not wrong in predicting that the heat engine of the "future will probably be one independent of the vapour of water".

(*v.*) However, it is not with water, artificially heated, but water utilized cold, and from its native upland springs, that I am now concerned. But here I will pause, for I am myself becoming excited on a subject so exhilarating, not to say intoxicating, as cold water, regarded as a factor in, or agent of Economics and Dynamics; and it is with me, I fear, in this matter, as it was with that precocious and imaginative young female scholar, for whom it was found that the *English Dictionary*—considered as a story book—was far too exciting and stimulating; for she could neither steadily read it, *nor let it alone*: because, (as she declared), it forced her, all at once, to think of so many different, but equally interesting objects of attraction, and important subjects for reflection.

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* Since this lecture was given, I have been told that electric energy could hardly be effectively carried and divided, (for lighting and dynamic purposes,) through so great a distance. I have given my authority; if incorrect, I must so far modify my conclusions.

Part 4th.—SCIENTIFIC—SECTION (*a*)—Through the air—across the sea--over the land, hitherto, have we journeyed together; to complete our Ulyssean wanderings, let us now adventure beneath the earth, and dare to enter the realms of Orcus and of Dis! Or, (although science need not be prosaic) to put it more simply, I will now attempt (although with diffidence) the fourth and last part of my lecture, under the somewhat pretentious head of local *scientific* geology. I hope, however, you will understand that in calling this conclusion, *scientific*, I am referring to the *subject* matter of it, and not to my method of treating it. I have already said that a geologist ought to be a chemist. There are several other things which a geologist ought to be: an astronomer—and physical geographer—a scientific mineralogist and a practical metallurgist—a meteorologist and hydrographer—a naturalist and botanist—a physiologist, comparative anatomist and entomologist, and perhaps specially, a conchologist and microscopist. It would be just as well, also, if he were an advanced mathematician, and a competent ancient and modern linguist; he *must* be something of a land-surveyor and draftsman, and if he be—(as my friend Mr. Sawkins was) a good landscape-painter, it would be all the better for him, even as a geologist. The changes of terrestrial formation may be well seen in a steamer coming up, in the cool morning from Morant Bay to Kingston—before the haze and glare of the day have set in—and I myself, have, when coasting the shores of the neighbouring island of St. Domingo, (where I have never landed) been able to detect, at once, the general local transitions, coastwise and inland, from stratified to intrusive formations, from trap, porphyries and metamorphic rocks to Tertiary conglomerates and limestones.

(*b.*) I may here remind you of those ancient and elliptical lines:—

Lingua, Tropus, Ratio, Numerus, Tonus, Angulus, Astra,
Rus, Nemus, Arma, Faber, Vulnera. Lana, Rates.*

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* Wool was the first fibrous substance used by man, and is the basis of all our textile industries, See History of Wool and Wool-combing. Jas. Burnley (Sampson Low & Co., London.)

In the first line are summed up the *liberal* arts, the pursuits (as we should say) of a gentleman, "*Languages, Rhetoric, Logic, Mathematics, Music, Geometry,* and *Astronomy.*" The second line includes what were then the *mechanical* arts and technical handicrafts of those who have to earn their daily bread by their daily toil, "*Agriculture, Forestry,*" "*Soldiering*" *Tool-making, Carpentry,* and "*Barber-Surgery.*" *Weaving* and *Boat-building.* We in modern days distribute these occupations, as pertaining to gentry and simple, somewhat differently ; or at any rate some of the *second* class have progressed themselves, so as to take leave of their former equals, and have got themselves (the "barber-surgering", for instance) deservedly promoted to the very top of the first grade ; but as far as the Geologist is concerned, such distinctions and distributions are quite unnecessary ; for to him *both* lines, in their *spirit,* if not quite in their letter, are applicable. The province of his Science (which is also an Art) covers at once the regions of Logic, Ethics and Physics, alike, and even has some claims on the aerial realm and domain of Poetry.

(*c.*) But for myself individually, I make no such pretensions, I have already honestly owned that I have very slender claims as to the possession of even the primary and more simple qualifications of a Geologist ; and, indeed, some of you may probably think that if so many requirements are insisted on, as I have enumerated, then a Geologist must be only a succinct, but high sounding name for, a "jack-of-all-trades-and-master-of none" ! And, truly, in *my* case you would not be far wrong. However, it is time someone recalled public attention to our Jamaican Geology, and so—with great deference, and also with some diffidence—(as far as that is separable from *doubt*) I stand here to-night—an illustration of Scaliger's line—"Aliquis in omnibus—nullus in singulis."

(*d.*) On the other hand, however, Quintilian (or Cicero ? I forget which,) says that it is not necessary that a forensic advocate should *thoroughly* master a science, or an art, connected with his case ; although he should carefully acquaint himself with so much of it as will enable him accurately, clearly, and effectively to apply his gatherings, in his arguments and illustrations ; and so then it now stands with me in, regard to this scientific and last division of my subject ; I am but a gleaner and salvage-storer ; only of what I have gathered, I have some difficulty as to selection, and rejection ; and so I hardly know where to begin, and it will be still more difficult to know where to stop, although the limit of time, will, fortunately apply to *my* strength and energy, as well as to *your* interest and patience.

(*e.*) I have prepared some rough maps and diagrams to which I now just briefly invite your passing attention.

Fig. 1 is a representation of the *mountainous* system of Jamaica; some pains have been taken to make it sufficiently correct for my present purpose : but it has no claim to exactitude. Physical maps of Jamaica are very rare, if even existent: I am indebted to Hon. Valentine Bell, Director of Public Works, for permission to copy in outlines an old and indistinct one, by Robertson (1804)—the best I could hear of. The scale being the same as the rough plan I now exhibit, viz., 2 miles to the inch, and all the larger maps I shew to-night are arranged to the same scale.* If I am not presumptuous, I would suggest that this want of a good Physical map of Jamaica, felt by myself as a school manager, (and I am sure felt also by other local educationalists, in regard to our schools of all grades) should be supplied by the joint action and co-operation of the Governors of the Jamaica Institute, the Chief Inspector of Schools, and the Crown Surveyor. It is by such crude efforts, as I to-night exhibit, that I have tried, from time to time, to supply this deficiency in my own schools.

Fig. 2 is another map of Jamaica on the same scale as fig. 1; namely, two miles to the inch. As fig. 1 may be taken to represent (so to say) the bony articulation, or skeleton of Jamaica; so fig. 2 may pass for a semblance of the arterial or venous system of the Island, or as a cross between the two; since (contrary to the animal economy) the channels of rivers are widest, and the volume of their contents greatest at the outlines or edges of the land; and the analogy further fails, that there are no *visible* means of return currents; as these in Physical Geography, are aerial, and not terrestrial, and are not closely superficial. Still, despite shortcomings, the analogy may serve.

Fig. 3 combines Nos. 1 and 2 and shews, while the river-courses at first sight, appear to make the contours and determine the general run of the mountains, yet if Fig. 3 be taken in connection and comparison with Fig. 4 (which is an enlargement of the general geological map of Jamaica, contained in the Surveyor's Report,) it will be gradually seen and realized, that it is truly the fundamental nature, and the various internal structural arrangements, and relative constituents of the mountains themselves, that are the main causes of the existence, and the chief causes which determine the particular location and directions of the river courses. Gullies and rivers will cut a more or less devious channel across an alluvial plain; because no geographical plain is, or ever was perfectly level all over, or evenly inclined; there are always slight risings and fallings, here and there on its surface; undulations, as it were, and however slight these may originally have been, the rain-water and springs, or the season freshets, at once, find out and follow the hollows in these plains, and in the course of time have grooved and channelled out their present natural drains and outfalls. In that case the formation will generally be exacted the same on both banks of a *small* lowland stream; and a large river will form --displace—and reform its alluvial banks, (by its flood-waters, or even by ordinary divagations,) pretty much, apparently at its own sweet will and pleasure. But in the mountains, however, it is somewhat different. A river-bed in the uplands is generally one of the indications of a superficial, or internal change of formation, or of a split, break, or fault in the same formation, statified or unstatified. Go to a pic-nic at Bog Walk (don't go in "tick-time," that is, when ticks are superabundantly prevalent,) and taking yourself away from the general company—(which probably will be too busy with its own devices to miss you, unless indeed it have special inclination, or inducement to watch you,) and, with, or without an agreeable and sympathetic companion of either sex, (I would advise the companion, and would recommend the other sex; only in this latter case, inducement to watch you (plural) is pretty sure to be excited) walk for three or four miles on the public road.

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* I heard just before this lecture was *delivered* that a new Map of Jamaica, of this scale already had been prepared by Mr. Thos. Harrison, the Crown Surveyor and his assistant Mr. Liddell, and had been sent to England to be lithographed, and it has since come back in its multiplied form. It is a very beautiful map for every purpose, *but geology*, as (no doubt to show up other more generally useful information) the shading of the mountainous system is very faint, (much fainter I am told, than in the hand-made copy, sent home by the Crown Surveyor; who is himself a good practical geologist, and has had an unrivalled experience of the surface of Jamaica. But unfortunately for me, the *scale* of the new map is *not* the same as Robertson's (1804), already made by me the base of all my superficial diagrams, because it is *just twice* the *lineal* scale of the Government Geological map; and therefore both are easy to adapt to each other, and to the rest of my rough plans, for comparative, topographical, Physico-geographical, or for strictly geological purposes.

"All along the valley, where the waters flow"—of the Rio Cobre and you will see instances of how that stream has washed out its way, between the junction of the hard limestone on the right, and the more friable conglomerate and shales on the left bank; but in some places, just near Bog Walk station itself, for instance, has taken a shorter cut, by grooving out a fault and fissure in the limestone itself; so that for half a mile or so, parallel to the rock, through which the tunnel is bored, you have limestones on both sides of the river and road.

Fig. 4. I have already referred to in speaking of fig. 3, but it requires a word or two for itself. It is enlarged (to enable you

to see it better) from the official Geological map of Jamaica, and many details are purposely omitted for clearness and simplicity. The official map is 4 miles to the inch, or ¼ of an inch to the mile; I have made the one now exhibited, ½ an inch to the mile, or two miles to the inch—to match in size figs. 1, 2 and 3, above referred to. It is thus four times the size of the Surveyors' Geological map in their report. Like the other maps, my copy is roughly done; it is for illustration rather than exact reproduction; still some pains have been taken to make it sufficiently correct; and for comparison, and (where need be) correction—a copy of the original is hung near to it.

Fig. 5, illustrates (roughly) all the chief *stratifications*, which geologists to this time, (or until recently at least) have recognised and defined in the earth's crust, and fig. 6, (by way of comparison and contrast) represents those of them which to this date are known to exist in Jamaica. The *average* thickness of these strata is taken in both cases, and both diagrams shown, are drawn to the scale of 1000 feet to the inch. The *general* stratigraphical map (fig. 5) gives us 9½ feet, (nearly) as requisite to mark the *average vertical* strata of the earth's crust, and presents to us the idea that these stratifications—(all of them--mark you—more or less sedimentary, and worn down and deposited in water, from—perhaps—far older rocks) amount, on the *average* to 111,450 feet, or 37,150 yards, or *say* 21 1-9 miles; say a little more than (one two-hundredth) 1-200 part of the semi-diameter of the earth.* Whereas our Jamaican vertical diagram (fig.6), showing how deep our knowledge of our soil extends beneath the surface of the uppermost (quaternary) geological formations, only requires, (on the map shown) a little above 8 inches of vertical space, representing 8,100 feet, or 2,700 yds., say about *one mile and a half* or less than one—two-thousand-five hundredth (1-2500) part of the semi-d. of the earth. In both diagrams (figs. 5 and 6) the metamorphic and intrusive or the eruptive rocks of igneous origin are represented as coming beneath these stratifications. Of these unstratified formations it is impossible to form any *scientific* calculation of their *average* thickness, and, moreover, they may, (*and do*—all the world over) crop out through primary, secondary or tertiary rocks, and so destroy the continuity of strata. They have done this very extensively in Jamaica, as you may see by fig. 4, which shows that nearly three-eighths (⅜) of Jamaica (see part III. sect. *e*) are even superficially composed of *unstratified* and intrusive rocks, and that these have either overlaid and obliterated, or totally changed, that is "metamorphosed," all of the older stratified formations (primary and lower secondary), if even there were ever any of these stratifications where Jamaica now stands.

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* Edward Clodd in his Story of Creation makes it 130,600 feet, or 43,538 yds. or say 24¾ miles.)

(*f.*) Of these metamorphic rocks *proper*, namely those which once *were* stratified, but have been either slowly changed by the long continued action of internal heat from below, and by pressure from above; or have been more suddenly and rapidly baked by the contiguous intrusion of fused and igneous matter; of these metamorphic rocks, I would say, they have at times not only lost their signs of stratifications and fossilization, but they have some times undergone, what I would elliptically call, isomeric changes, that is, their elementary chemical constituents have been rearranged. All strata may thus become metamorphic; but metamorphism must be distinguished from substitutions, where one mineral (say lime) has been washed out, and another mineral (say silica) replaced; when these more soluble minerals find their way (as they often do) into the dead tissues of recent vegetable and animal organisms, they are called petrifactions. However, of metamorphism, its distinctions, differences and divisions—structural, molecular, chemical, dynamical, statical, thermal, &c., &c.; or (*a*) Siliceous (*b*) Argillaceous and (*c*) Calcareous—as they are sometimes classified, I can say little more here than I *must* say to help me along to other matters.*

I have prepared and now exhibit some other maps or diagrams. They are intended to illustrate the physical geography of Jamaica, even more than its geology: but the line of demarcation between the two sciences, is, as I have already hinted, (IV *a.*) a very fine one, or rather there is a neutral zone, or common territory between them. Some of these diagrams shown are also intended to explain various mining problems, connected with our Jamaican "speculative" geology; but they also serve to show actual or possible local variations from the two formal stratigraphical maps, or diagrams (figs. 5 and 6) which I have made for comparison with each other, (as I have already explained,) and for this latter purpose I have chosen, first, those cases which show the intrusion of our igneous or eruptive rocks, through those that are stratified, and second—as best suited to my present audience—those instances that occur in the neighbourhood of Kingston; and the diagrams are most of them enlargements of sections taken from those in the Geological survey—of which there are also drawings in the Museum of the Jamaica Institute (downstairs). I shall indeed now be able to do little, but just by a word here and there to refer to and apply some (not all) of these several diagrams. They will, however, sufficiently serve their present purpose, if they enable me to shorten my further speech—save your valued time, and relieve your already sorely tried patience. In entering, however, on such a theme, as that now before us, we are exchanging superficial for cubic expansions, and not only around, but above and beneath us—not only in *space*, but also in *time*, the subject projects itself *illimitably*!

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* The following was written, but for brevity omitted at the lecture. In popular lectures, not intended to teach systematically from rudiments and first principles *upwards*; the various sections of the subjects, which have to be touched upon, cannot, of course, be treated, exhaustively. They can only be taken on their more striking aspects—or more prominent—and if possible—attractive characteristics. The lecturer *then*, is not so much a teacher, as an advertiser of his subject, and he therefore selects "*tit-bits*," and seeks to illustrate and popularize these. Yet, on the other hand, he must prove that he is not merely a show-man, and charlatan. He must not be densely ignorant, nor in outer error as to the collaterals and reciprocals of his theme. I can therefore, here and now, in respect to both these conditions, one on this—and the other—on that hand—only say that this whole question of geological metamorphism is connected with both the older and newer theories, in regard to the formation of "mountain-ranges"; which although in many ways, a subject bearing very intensely upon Jamaican geology, I cannot treat of in a paragraph or even in a section; and must therefore refer to Mr. Millard Read's book on the subject ("Mountain-ranges"—Taylor and Francis—London). also to several articles by the late R. A. Proctor, published in "*Knowledge*"—a periodical he edited, and also to his article in the *Fortnightly* of April 1888, on "The everlasting hills" to which last, I shall have occasion to refer further on in this lecture—see part IV. sect. k.

(*h.*) I would, especially at this late stage of my address, wish to keep clear, or as clear as I can, of "Nebular Hypothesis," with which our earlier and more vague ideas about Geology are sure to get entangled: save only this I must say, that the more recent modification of that theory, suggested by Mr. Norman Lockyer (which has been called the bolidal or meteoric theory), will, in my opinion, be more generally acceptable to geologists than even to astronomers; because it seems—by shortening the periods necessary for the *earlier* portions of kosmic evolution—to give, in part at least, more time for *latter* developments; which time geologists have usually required for the original deposition, or condensation and arrangement of the telluric constituents of their science; and in this demand they are joined by the biological evolutionists: whereas, on the other hand, mathematical astronomers tell us, that according to the theory of Nebular Hypothesis* as originally conceived by La Place, and gradually formulated by his followers, with many radical variations, into a semi-scientific system (half gravity, but the other half guesswork); by this theory, then, the vital energy and heat of the central sun itself would have been dissipated and lost, long before this time, in the millions of ages that geologists demand, first, for the sufficient condensation and cooling of the earth's mass, and the concentration of its volume; and *next* for the forming and solidification of its primative crust, and also for all the subsequent changes that have taken place on the earth's surface; rendering it, at last, capable of and for such a long time suited (as we know has already been the case) for supporting vegetable and animal life, terrestrial, fluvial and oceanic. So that between the rival positions, in these matters, of the astronomers and geologists, there seems to be quite sufficient ground and reason for the old-fashioned theologian to hold his own, as I have myself never had a doubt that, in all essentials of his creed, he *could* and *would* do. Save then for these allusions and applications I will steer clear of Nebular Hypothesis, or any other hypothesis.

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* See Appendix A, on "Nebular Hypothesis," and see of *this* Lecture, part IV., section *k*, (5th)—and of Lecture II., part III., section *e*, (note to).

(*i.*) It is told of king George III. that in the later and more infirm years (physically and mentally) of his life, he on one occasion, illuding his attendants, strayed beyond the royal park at Windsor, and not being recognised, took shelter and was regaled in a poor woman's cottage with a hot apple-dumpling. The poor king appreciated the, for him, rare though simple dainty, and feasted on the unusual fare; but was, when restored to his custodians, for some days after sorely puzzled—(until he took some one into his confidence)—to determine and understand how the apple had got into the dumpling; for (as he remarked) he had been careful to observe before he cut up the dumpling that it had *no seam in it!* In regard then to the present condition of our various superficial and statified geological formations in Jamaica, and their last upheavals, or previous ones (by the igneous forces beneath them, or by the general shrinkage or contraction, by cooling, of the whole globe itself); although I have read and thought a good deal about the "*why*" and the "*how*" and the "*when*;" yet I have now no time left me to give you at first, or better still, at *second* hand any theories or proofs as to how the apple got into the dumpling. There is a short and simple, but sufficiently correct outline of Jamaican geology in chap. v. of the Rev. W. Simms' "Elementary Class Book of the Geography and History of Jamaica." (Geo. Henderson & Co., Kingston). I will now only quarter and cut open the dumpling, and show you what is within it; and this I must ask you to suppose and accept, that I have at least practically done for you, in yonder (or in the above named) figures and diagrams, of which I have said, and can now say only a word or two *en passant.*

(*j.*) The rest of my remarks will therefore be of a more general, but I hope not wholly of a discoursive and irrelevant character. In regard then to the stratified rocks of Jamaica—the dough of the dumpling—(if I may illustratively so call them) you will see from the stratigraphical diagrams (figs. 5 and 6) that the Geology of Jamaica is, *in theory*, comparatively simple, and its record (relatively) chronologically short and recent; and if on cutting open our dumpling—(I fear here my analogy partially fails us, as analogies (like metaphors) are apt to do—for obviously, even at first sight, there *are* very many seams on the surface of our dumpling, fig. 4; but nevertheless, ignoring that difference) if (I say) on cutting it open, we had found the dough in flaky layers, as in figs. 5 and 6, or like the concentric circles of a sliced onion, why! then there would be *one* less, but only one less mystery to think of, and to speak about, as to either the philosophy and metaphysics of the *subject*, or the mathematics and mechanics of the *object*. But a comparative or contrasting glance, (and contrast implies previous comparison) all round at the plans and sections shown, will, I think, at once convince you that in regard to trying to explain and account for all these complications, although my speech should be even "silvern," that my silence will be absolutely "golden."

(*k*.) I will, however, just state, as briefly as I can, some of the difficulties which meet us, (I could name at least a dozen, but I will spare you *half* that number) when we attempt to reduce the geology of Jamaica to a system.

1st. Jamaica is an island, therefore its geology does not readily and gradually shade itself off into, and admit of close comparison with adjacent and contiguous formations. There is a want, then, of *lateral* sequence—superficial regular transition—which might otherwise be utilized to direct our observation, and to strengthen and assure our deductions and judgments.

2nd. Jamaica is neither a very *small*, nor yet a very *large* island. It is not like the Isle of Wight or Barbados: either of which you could go over, with a geologic eye, in less than a week; and it is not a very large island, like Borneo, or New Guinea, not to say Australia—all of which are big enough to become a law unto themselves, and can afford to have (if they wish it) a geology of their own, as, indeed, Australia, at least, has a fauna and flora of its own.

3rd. Then, the nearest lands to Jamaica are also insular, and they are neither very near—(so that we can reasonably surmise that their geology is the same, or like ours); neither, on the other hand, are we as far off from them, as St. Helena, and Ascension are from each other, and from the mainland of Africa; and therefore, probably, having no direct geological connection. (See diagrams and sections, figs. 21 and 22, of distances, &c., &c., between Jamaica and Cuba, and Jamaica and Hayti respectively). Then, further the nearest islands to Jamaica of any note—that is to say, Cuba and St. Domingo are neither of them British possessions, and as far as I know, have not yet; either of them, been—even partially, and scientifically and geologically surveyed; so we do not get any help, with Jamaican geology, from those quarters: indeed, despite what I have already said about my observations made in coasting St. Domingo, I in truth know not very much more about it, *geologically* than I do geographically about the surface of the planet Mars, and a little less than I know about the localities on the visible side of our satellite the moon; and the data of my information about all three have been gained by the same means, viz., by looking at them through a telescope!

4th. Jamaica is very mountainous. I think I am right in saying that our Blue Mountain Peak is the highest land in the West India Islands, and I believe I am also right in thinking that it is the highest *accessible* and habitable land in the Queen's *settled* dominions. There may be some snow-clad or volcanic peaks in New Zealand which are actually higher; but I do not think even Mr. Whymper succceeded in scaling many of them. Whereas there may be half-a-dozen persons now present who have got to the top of the Jamaica Blue Mountains (7,335 feet)* But, indeed, Jamaica is even more mountainous than it seems to us to be, (if it be not an Hibernicism to explain this statement in the way I am about to do), for Jamaica is really, but the exposed ridge, or part of the ridge—of a great submerged mountain range† Draw off (in your imagination) the waters of the Caribbean, and convert that sea into a plain, and then the Blue Mountain Peak would so tower above the level of what is now the sea-bed, that it would be an eminence much higher than seems to European tourist, Mount Blanc, or the Matterhorn, or any other horn in the Alps; and even, save for the lack of snow or volcanic smoke, would appear as the rival in height of many of the loftiest of Andean summits—as seen by voyagers from the Pacific coasts. Seen (as I ask you to conjecture) from the sea-bed between this and South America, our highest mountain in Jamaica would appear at least 19,000 feet high; and as seen from the bottom of the deep valley between th. and Cuba, (although the strait is barely 80 miles wide), then our Blue Mountain top would soar up to a peak 28,000 feet high! The rival, in apparent altitude at least, of some of the higher of the Himaleh* Mountains themselves.

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* The chief altitudes are marked on the enlarged Geological map, No. 4, shewn at lecture, and also in figs. 4, 25 and 26 there are represented "elevations" of Jamaica—(*a*) with the vertical and horizontal proportions on the same scale, that is as Jamaica would actually appear out at sea, if at one view, we could see the whole of it, which, for various reasons, we could not do: (*b*) with the vertical elevations exaggerated as (for effect) physical geographers are generally obliged to do—Jamaica, however, lends itself better to the natural arrangement (in *a*) than most places do; for the altitude of the Blue Mountain peak, is to the whole length of the island as 1½ is to 144, or 3 to 288 or 1 to 96 (nearly). But England and Scotland together, as to their highest points would scarcely be to *length* as 1 is to 600, and even South America, with some of the Andean peaks probably 22,000 feet high, would only give height as to length, as 4 is to 4,000 or as 1 is to 1,000.

† The line of soundings between Jamaica and Navassa nowhere exceeds 240 fathoms, and between Navassa and Hayti 520 fathoms, see fig. 22.

By the way, our Blue Mountain Peak had a narrow escape (or we had) of its being a volcano. It was tapped, and a stream of lava exuded from it, long ages ago, and flowed into the sea at Low Layton in St. George's (specimens shown). There is also a narrow dyke of basalt (another volcanic rock) at Shot-over Hill in Portland, indicating that another eruptive molten rock stream once glided there. We know that this lava, at Low Layton, flowed after the Miocene periods, because there are blocks and fragments of disrupted Tertiary, now embedded in the lava; (small specimens shown) and we know that the eruption took place very long ago; because there is very little lava left, and what is there, is much disrupted and disintegrated, and overlaid by subsequent deluvial strata, or detrital deposits; and what still appears, is only what is left after much erosion, the deficiencies having been carried clean away by rivers and floods. There is also local evidence that after the lava was extruded, and had embedded the limestone, that it was submerged, for a considerable period, until a good thickness of marl and sea-shells had been deposited upon it, and it has also been partially destroyed by sea agency, and then, lastly, raised, as it now is, at least 700 ft. above the sea level, and overlaid with other formations as above described.† But all this is just at this place and moment a digression, although I should have no better opportunity to-night afforded to me of getting it in—nor can I say anything much as to whether slow upheavals and depressions of parts of the island are still going on; save to remark that they are both possible and probable; although such an experienced observer as Mr. Harrison, the Crown Surveyor, has not detected them; although from other sources (not so dependable) I have heard something that looks as if the North-east end of this island *has* risen—say a yard or so, since I was a child playing on the sea-shore there—50 years and more ago. I repeat then—Jamaica is very mountainous and even more so than it superficially seems. You can on a fine day, with a clear atmosphere see the faint outline of the St. Jago-de-Cuba mountains from Cape Clear in Metcalfe on the Northside of this Island; but the sea-bed between the two points is abyssmal. There are some respectable depths of 10,000 feet at least on the southsides of Jamaica, and of St. Domingo in the Caribbean sea (fig. 27 pointed out) that are nearly two miles deep, and much more *below* the present surface of the sea, than our Blue Mountain Peak is now above it; but the depths in the comparative narrow strait between our Northside and Cuba exceed these. Twelve miles due north of Annotto Bay, we get sounding of 11,000 feet (over 1,800 fathoms, a little over two miles), mid-channel the bed rises, and the depth is about 7,000 feet, but 20 miles from Santiago the depression is nearly 19,000 feet (fig. 21 shown) 3,140 fathoms, more than 3 miles and a half; (see sectional diagrams shown—figs. 19 to 27) nearly as deep as the deepest part of the North Atlantic, which spot, I believe, is about 80 miles east of the island of St. Thomas (3,875 fathoms, 23,250 feet; about 4 miles and ¾ deep) see fig. 19 shewn—at lecture.

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* We are told that in future we must no longer call them the Himălēhs or Himălāya, but the Himālăya or Himāliă, that is the "*Abode of Snow.*" See *Nineteenth Century Review*—June, 1889.—page 813.

† Geological Report, page 120.

5th. Another difficulty about our Jamaican geology arises from the fact that our tertiary stratifications and formations have so little of the Secondary, and apparently none whatever of the Primary rocks beneath them. As I have already pointed out, (part IV, sect. *k*. 1st) the want of *lateral* connections, so now I have to notice the absence and need of sufficient *vertical* antecedents. Thus our Miocene (tertiary) and Cretaceous (secondary) Limestones—"hang in the air" as it were ; they have nothing beneath them of the recognized older stratifications on which the mineralogist and palaeontologist can super-impose them and shade them into. In other words the metamorphic and igneous rocks at once follow ; and beneath these last we have not, and most probably shall never get, in Jamaica. On the *general* stratigraphical diagram shown (rough as it is) you will see marked, and variously coloured, at least 15 distinct eras grouped into four Periods, not counting sub-divisions of those several eras. In Jamaica we have only six stratifications, that is—

Two post-Tertiaries, (*A*) Alluvium and (*B*) Coral or Coast Limestone. We have *three* Tertiaries well developed. (*C*) White and Yellow Miocene, (*D*) Eocene Yellow Limestone and Fossiliferous Clay, and (*E*) The lower Tertiaries, or Upper Conglomerate and Trap series. Of the Secondary, we have discovered to this really only ONE (*F*) the upper Cretaceous or Hippurite Limestone (Blue.) We next come to (*G*) the Unstratified, or, at least, unconformable rocks of the lower Conglomerate and Metamorphic series, and then we get, at once, to Porphyries, to Diorite, Syenite and to Granite, (*H*.)

(Fig. 18 is here reproduced on a small scale. One copy of it, coloured (to match the other Geological maps and diagrams shown,

GEOLOGY OF JAMAICA, Part IV. Sec. *k*, (5th).

Fig. 18.				Feet.	
STRATIFIED FORMATIONS.	Quaternary.	A		300	Alluvium, &c., &c. 1, 2, 3, 4, 5, 6.
		B	1	50	Coast and Coral Limestone. 1, 2, 3, 4, 5, 6.
			2	250	Marls, &c., &c. Red and White 1, 2, 3.——1, 2, 3.
	Tertiary.	C		2,000	White Limestone (Upper Miocene). With and Without Fossils. 1, 2, 3.——1, 2, 3.
		D		500	Yellow Limestone and Clays, Upper Conglomerate—(Upper and Middle Eocene). 1, 2, 3, 4, 5, 6.
		E		1,500	Lower (Eocene) Tertiaries, Middle Conglomerates. 1, 2, 3, 4, 5, 6,
				1,000	Trappean series, and Carbonaceous shales. 1, 2, 3, 4, 5, 6.
	Secondary.	F		500	Cretaceous (blue) Limestone. Hippurite Limestone, Marbles, lower or true Conglomerates. 1, 2, 3, 4, 5, 6.
Doubtful.	Metamorphic, &c., &c.	G		2,000	Metamorphic series and Crystalline Marbles, &c., &c. 1, 2, 3, 4, 5, 6.
UNSTRATIFIED.	Age uncertain and periods of deposition unknown.	H	1	..	Porphyries, Diorite, Syenite and Granites. (grey, red, and green) 1, 2, 3, 4, 5, 6.
			2	..	Igneous and Volcanic Rocks. Lavas and Basalt 1, 2, 3, 4, 5, 6,
Average thickness of stratified rocks, &c., A, B, C, D, E, and F. G is semistratified.					The figures 1, 2, 3, &c., represent specimens of each kind of formation, laid on a diagram like this, (only 5 ft. by 3 ft. in size), on the table at the time of the lecture.
Total Feet ..				8,100	

GEOLOGY OF JAMAICA.

Hints to assist in colouring the rough Geological Map annexed to these Lectures, so that the colours may agree with those used to represent the various strata, in the Government Geological Map of 1865.

Nos.	COLOURS.
1	Pale Greyish Yellow.
2	Dark Grey.
3	Reddish Yellow.
4	Light Grey.
5	Light Blue.
6	Green (dark).
7	Salmon colour.
8	Dark Brown.
9	Dark Blue.
10	Green (pale).
11	Pale Purple.
12	Yellow (bright).
13	Purple Pink.
14	Crimson Lake.
15	Pale Pink.
16	Reddish Brown.

and of 5ft. x 3ft. in size) was hung up, and a second copy was on the table, with specimens from the Jamaica Institute Museum, placed upon the diagram, wherever the numbers 1, 2, 3, 4, 5, 6, are there placed).*

The fact is, although Jamaica has *agriculturally* a deep and fertile superficial soil; yet *geologically* speaking—*we come too soon to the granite*;† yet very much granite does not actually crop out at the surface, but it is not very far off, as vertical distances go in geology. Our Jamaican Geology is then a little like many of our natural and uncultivated Jamaica fruits. We have not enough pulp and flesh meat, and we come too soon to the *stone*; the shell of that is too hard and too thick for us ever to be able to crack it and get to the kernel within.‡ We think of the Voice out of the whirlwind asking the patriarch Job (xxxviii. 4) "Where wast thou when I laid the foundations of the earth?" And therefore it is with reverent spirit and with bated breath, we too would fain enquire, "What was going on, at that part of the globe's crust where Jamaica now stands, when the lowest Primary, or even the lower Secondary sedimentary rocks were, during hundreds of thousands, and perhaps millions of years, being slowly deposited?" And, going at once from the bottom to the top of our general stratigraphical diagram (fig. 5) "Was Jamaica above or below "the sea, during the great northern, or deluvium periods of the Quaternary age; of which up to this time we have not, in Jamaica, discovered a single trace?" "Were there, in this human, or all but human period, glaciers on the sides of the Blue Mountains?" or "Was it, as Columbus at first supposed it still to be, all open sea from Southern Europe and North Africa, right away, westward to the Indies and Cathay?" *We don't know*; most likely, on this earth, man will never know: or, to confine ourselves to our special Tertiary period, in Jamaica, we may query, "When was our last upheaval above the sea surface?" "When the last intrusion of eruptive, or last transformations of stratified into metamorphic rocks?" Even all, or any part of this, we do not know; although we *do* know that when Juan-de-Bolas and the Blue Mountain Peak reared their heads (either by the *same* or by different upheavals) they destroyed three-eights of our superficial Tertiary limestones, and played sad havoc with the upper Secondaries, and caused utterly to vanish (if they ever existed here) all other and older stratifications; and we also know from sufficient evidence (you may read it in page 82 of the Geological Report) that the East coast of the island has, since the deposition of the upper Miocene limestone, which is itself a deep sea formation, been, raised at least 1,200 feet; because some sea-shell fossils, (Pteropoda) which are now 300 feet above sea-level, never live, save only in the abyssmal zone of Professor Forbes, and that is, at least 150 fathoms or 900 feet deep. Here then are surely local Geological subjects enough, both for speculation and reason,—for poetic imagination and exact science. I heard a Doctor of Medicine once say, that you must dissect "a whole hatful of eyes," before you half understood one of them. (That is the eyes, not the hats.) When we get a few men and women in Jamaica of sufficient means, and learned leisure, whether they be scientific strangers and visitors, or resident patriots and investigators, there is a whole lifetime of honest work cut out for a few of them, to examine carefully and analyze our conglomerate, trap, and metamorphic rocks, and to try and find out of what previous older formations, stratified or unstratified, they are composed and compounded. R. A. Proctor says, in an article on "The Everlasting Hills," published in the April 1888 number of the *Fortnightly Review*, (being almost the last of his contributions to the periodical press) "More wonderful by far, however, than even what the earth reveals, as to her age, through the evidence of strata, actually in existence, is what it tells about the "missing leaves" and chapters of the mighty volume."* * * * "The very evidence which remains speaks of a much vaster body of evidence which has been destroyed"* * * * And he says that "the layers which remain speak of evidence destroyed, quite as clearly as of evidence gathered, and the evidence destroyed, must have been far greater in amount than that which still exists." All Proctor says on this subject is very interesting, and is closely to the point now before me, indeed suggested it. But I can now quote only one bit more from him, viz: Whereas Wordsworth says:—

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* See diagram, fig. 18 on opposite page.

† Some geologists are beginning to think that even granite may be a metamorphic rock, formed out of far older stratified (*i.e.* sedimentary) formations, see part IV. sects. *f* and *h*, (notes) and Lecture II. part III. sect. *e*, (note to.)

‡ In California and Australia, however, most of the gold and copper deposits now being obtained, are got at by driving deep vertical shafts clean through the superincumbent lava flows and metamorphic rocks, down to older stratified and water-worn formations beneath.

The thoughtful mind
Mourns less for what time takes away
Than what it leaves behind.

Proctor's comment on this is:—"The thoughtful student of science *is less* moved by what time has left *behind*, than by thoughts of the evidence which time has removed." And if all this be true of the larger stratigraphical map of the general crust of the earth now exhibited, (fig. 5) which is really what Proctor was thinking and speaking about—how much more true is it of that mildewed and moth-eaten, torn, tattered, and crumpled fragment of a primer, (Fig. 6) which is all that Dame Nature has handed to us, out of which to "get up" our native Jamaican Geology!

The 6th and last difficulty I shall now name and comment upon, as hindering us in reducing our local formations to method, by subjecting them to a scientific analysis, is that Jamaica has been frequently, very frequently submerged and raised again; incidentally, and in regard to one or two districts I have had to allude to this already. (Part iv., sect. *k*, 4th, 5th.) But now of the island as a whole, I have to observe of that Miocene limestone, of which, despite all disruptions, about five-eighths of Jamaica are still superficially composed; that it could, or rather the fossils in it, would tell us some strange tales, if they could only speak. This Miocene formation is very scarce in Great Britain, is only found in Devonshire and a few other places, and in these of no great thickness, or much in amount. But it is found in the central part of the continent of Europe, and in some districts of North America, and it is estimated at 6,000 feet of *average* thickness, and it is (generally speaking) a slow deep sea deposit. In our Long Mountain to the East of Kingston, it is about 1,500 ft. thick, and above sea altitude, and probably the Eocene clay is only at most two or three hundred feet below the present sea level, as it crops up about Mona. So most of the Miocene limestone in the Long Mountain is, so to say, above ground.* In Mount Diabolo this limestone is probably 3,000 feet thick. Now our Miocene strata have not yet been much examined, but as I have said—and speaking *generally*—they are without doubt a deep sea formation; as the Eocene beneath is a wide, but shallow sea deposition During the trappean shale and upper (and also lower) conglomerate eras, Jamaica may, have been (partially at least) either above or beneath the sea, probably sometimes one, and sometimes the other, and occasionally between *both*, *on-a-wash*, as sailors say, of a water-logged, and derelict craft. For these last named formations are very irregular and composite, and their materials have been much water-worn; but the conglomerates at least, contain silicified wood, and the other shales, have narrow beds or bands of lignite; all which mean land deposits, or at least drift to the sea from adjacent land, and probably elevated forests. The Cretaceous limestone (beneath the shallow-sea Eocene) is again (like the Miocene far above it) a deep-sea formation. So we have this alternation, of sinkings and risings.

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* In a *very severe* earthquake, after very heavy rains, it is not impossible, that the whole of the Long Mountain might slide off into Kingston harbour and *not stop there*; but bury itself in the deeper sea to the south, or crumple up and block the east channel to that harbour.

See also figs. 18 and 28, Part IV., sect. *k.* (5th). But this is not all. The Miocene limestone itself was not all deposited at one submersion. In Europe it has been found that some of its intervening beds and layers contain, not only fossils of terrestrial plants and insects, but also of land mammals of the larger and older species. Fancy in our Long Mountain we may have some gigantic mammoths and mastodons, or rather the older Tertiary pachyderms locked up!* And these changes in the Miocene rocks from sea to land fossils, and back again to sea fossils are found, more or less, apart from each other, and probably therefore without much intermixture of the marine and terrene fossils, as the effect of drift. Now doubtless all this, or much of this, on further search, will turn out to be so *here.* This of course means (whether the land and sea fossils are locally mixed or not) successive, or alternate submergencies (and deep ones) beneath, and upheavals (and probably as high as those at present existing) above the sea level, of this Tertiary Miocene limestone itself, in the course of its deposition; thus adding of course very considerably to *the time* it took to deposit most of its beds in deep salt water. And there are several other proofs, that I cannot now further, specify, than I have already done in this lecture, that the whole of Jamaica has been frequently submerged and resurrected. Save then for these allusions already made to interior, and superficial earth motion, normal or seismic; and also save my remarks on the lava flow at Low Layton, I have had to cut out of my present address, all I had intended to say on *Dynamical* Geology, under which head experts class all that is known scientifically about volcanos and earthquakes. Although the latter, at least, have become a speciality of study, chiefly so, by the researches and experimental observations of the Scoto-Japanese school, represented by Messrs. Ewing, Grey, and Milne; and so this subject has become of itself a subscience, under the title of Seismology.

(*l.*) But to return and to conclude; all this in regard to the depressions and upheavals of our strata in Jamaica appears to me to be very interesting, even from a literary and idealistic, or even artistic point of view, and serves to stir the staid imagination of the scientific mind, and to stimulate the usually impassive nerves even of the palaeontological anatomist, and of the mineralogical chemist. Sir Frederick Bramwell, the celebrated engineer (and I may add the brother of the no less celebrated English judge, Lord Bramwell) Sir Frederick Bramwell, whom, for another purpose, I have already quoted to-night, indeed claims that even engineering has its poetical side. Surely, then, if ever science becomes inspired with poetry, so as joyously to burst forth in rhapsody, or reverentially to chant a threnody, it will be on the cognate subjects of the profundities and dazzling glories of Astronomy; or else on the marvels and mysteries of Geology.* "The song of the shell" then, which I should like above all others to hear would be what an Eocene Echinus, or Miocene Nummulite *ought to* be able to sing to me, if only my ears had the etherial sense to hear and understand it. "All deep things are song," says Carlyle. He also has somewhere, (in his Past and Present I think), a fine passage in which he bewails, that while the Muse of History enables us almost *to see* the famous men and women of the earlier time—to know their forms, features and movements; sometimes still to handle their jewels, weapons and dresses, (as if we had but yesterday seen the owners of these, acting on a stage) that we cannot get them to *speak* to us, or to deign to be at all conscious of our observation of *them*, or even of *our* very being! The geologist is in these aspects, still more unhappy than the antiquary and the historian. Even the post-deluvian mummies, embalmed in their marble sarcophagi, have blazoned on their cere-cloths, their life's record of wisdom, or of valour and power, and the Egyptologist is, for us of these latest days, unriddling their old-world story. The hieroglyph and superscription are also on the rudimentary fossils, even of the Eozoic age, but there is no Joseph to recall, as from a dream, their vanished memories, no Daniel to interpret for us, their remaining symbols graven by mysterious hand on the walls of the per-durable rocks! For the palaeontologist desires, indeed, but *dares* not even to conjecture what the corals of to-day could tell us of their remotest ancestry and primal habitat, if only they knew and could recite their pre-historic pedegree. Alas! man's proudest and widest knowledge can be readily measured by geometric standards and gauges; but his nescience, *that* is boundless and profound, and can only be compared to, and illustrated by solar proportions of magnitudes of matter, and stellar infinities of space!

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* This would, however, shew that Jamaica was once part of a large continent, which is very doubtful now. Although Ceylon was once part of India, so there are Cingalese elephants.

(*m.*) And so at last it happens with all the foremost thinkers and workers of their time, as it did to those grand and deathless sons of men, Odysseus and Æneas, Dante and Milton, who while still living on the earth, did with heroic audacity attempt to descend Avernus, and through the Cumean cave penetrate and traverse the Plutonian realms; that they come at last to a Tartarian gulf, into which, indeed, they may for a few moments hurriedly gaze, but can neither enter nor cross over. And so here the Sibyl bids us also turn again, and seek the upper air (Virgil, Æneid VI. 573-579 and 628-641). And I who have to-night tried to lift, for your gaze, one corner of Nature's Eleusinian Veil—more as a neophyte and postulant in the temple porch, than as a hierophant before the altar of the Infinite—can only myself turn back also from the sacred gates, and with mingled hope and awe, (in the words of one who worshipped there before me), exclaim ;

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* "Where are the fictions of the fancy compared with the vistas revealed by "astronomers, biologists, physicists, and geologists?" T. A. Symonds *Fortnightly Review*, January, 1889, page 77.

> " Of the Universe of GOD, there is no END :
> ————and lo ! There is no BEGINNING !"
>
> —GOETHE.

Before I sit down I should like to make my acknowledgments to all those to whom I have been in any way indebted for help or information, counsel or books in preparing this address. I cannot now specify writers or speakers by name more than I have already done ; although I might have named many more. I will confine myself to local countenance and assistance. In this connection I have already mentioned a few names, and without repetition would here include thanks to their bearers in this expression of my gratitude. I would now, in addition, mention Commodores Prattent and Hand, for permitting me to inspect and utilize Admiralty Charts, and Staff Commanders Hammond and Dixon, R.N., for shewing me how to make, to scale, sections of soundings, and for other aid and information. I am also indebted to Mr. Liddell, Assistant to the Crown Surveyor, for actually making the charts of soundings presented to your inspection to-night. I have to thank Mr. Bowrey the Island Chemist, for a peep now and then into his fine binocular microscope, and also for an occasional hint on chemical points. (The blunders, however, I have made to-night in chemistry, and on other subjects are wholly my own): Mr. Bowrey and his assistant Mr. Cockburn have also given me great help in selecting from the Museum of the Jamaica Institute, (by the permission of the Governors) the Geological and Palæontological specimens utilized by me this evening. My friend Mr. Harrison, the Crown Surveyor, who is at present off the island, (or I am sure he would have been here to-night) has at various times given me both information and counsel, much of which for lack of time I have had to-night to leave unutilized, or at least to hold in abeyance. I have to thank a few other personal friends, for needful and ready help ; especially two young ladies, one, for adjusting, redrawing to scale, and colouring my crude diagrams, and the other, for fairly copying out of my several note books, and rough manuscript drafts, the *ipsissima verba* of this lecture, as now presented to you. Mr. Priest, the Secretary and Librarian of the Jamaica Institute, and his assistant, Mr. Hall, have always given to me every facility in using the resources of the Public Library, and the Rev. John Radcliffe, one of the Governors of the Institute, has often afforded me the benefit of his private countenance, scholarship, and experience; and further by his example and fame, as a practised, instructive and popular lecturer has set before me a standard, (although to such excellence I cannot attain) of what a public lecture *ought* to be. I have, however, trespassed upon his example, in my length and diffuseness, in contrast to his classical brevity and epigrammatic point and pungency, which two last are (as adopted by *him*) savoury and stimulating, and not either whimsical or venomous. I have therefore myself two-fold need to thank my present audience; first, for its attention to such a generally uninteresting subject as the Geology of Jamaica; and next, for the patience (and I trust I may add favour) it has shown to my method of treating it. Within my own profession, I have an unhappy reputation of being both puzzle-headed and long-winded, and I fear (as far as the last at least is concerned) I have done, or rather said much to-night to extend and to confirm this evil clerical character. I can only plead, in mitigation of judgment, that I have laid before you, in as concentrated a form, as I can produce, the careful collections and considerations of five and twenty years; and I have, to-night, cut out even more than I have conserved and presented to you. But this apology is itself growing prolix, and therefore, as my last words this evening, I have to thank you Mr. Chairman, and the other Governors of the Jamaica Institute present, very cordially for that presence, and your genial countenance and support.

Feb., 6th 1889. H. S.

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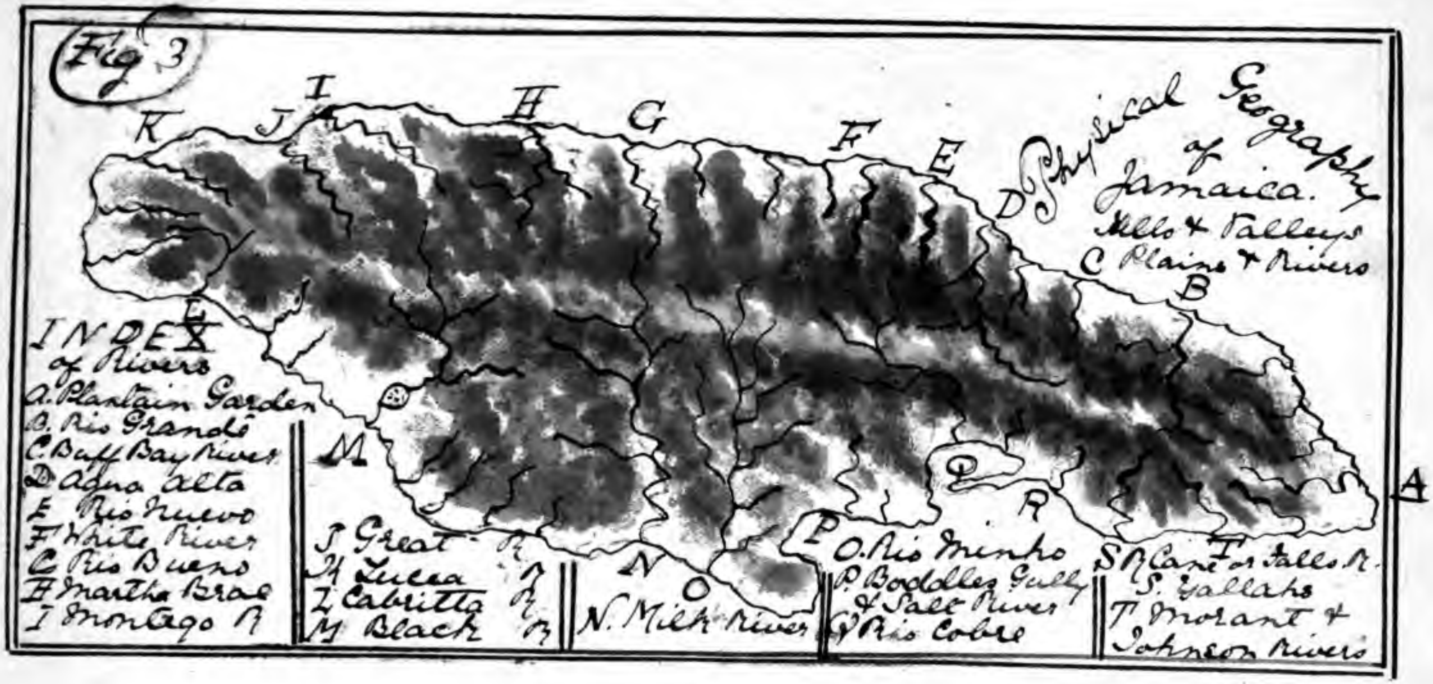
pour originally come from, or if *everywhere*, how did it get there ?" and, secondly, we wonder " Where would the cold localized solid eventually be ?" Would it be stationary ? or if that be impossible, whither would it be dynamical rotating and moving on ? What can we conjecture, but—*from nothing to no where !*

The simplest explanations, that do really explain, are always the truest, and so I might, as a tentative and working theory, accept Nebular Hypothesis, if its beginnings be formulated in accordance with Gen. i. 1, Ps. xxxiii 6 to 9, and Heb. i. 10. And as to the future, I conclude that the simplest physical teleology is that of Isa. lxv. 17, 18, and the best eschatology is that of St. Peter and St. John (ii. Peter iii. 13, Rev. xxi and xxii).

This note is appended to relieve the minds of some anxious " *Christian*" inquirers of mine (weak brothers and meddlesome sisters, I fear, most of them) who—(since I have publicly lectured on the facts of general and local Geology—and they evidently were not present when I did so—would indeed have thought it touching the unclean thing, to have countenanced me with their company on such occasions)—have, some personally—(and for these I have some *slight* respect)—and others anonymously,—(and for these I have no respect at all, despite their self-appropriated *Christian* authority,) some of these - I say—have written me, (and the worst of it is, they have done it more in sorrow than in anger)—and warned me, " as a clergyman of the Church of England ready " to deny the Biblical account of Creation," or have pointed out to me and chided me for my error in not seeing " my inconsistency in associating myself—as a " teacher of Christianity—with unbelievers in the Christian religion."

H. S.

Fig 3


Physical Geography of Jamaica.
Hills & Valleys
Plains & Rivers
A
B
C
D
E
F
G
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I
J
K
L
M
N
O
P
Q
R
S
T
INDEX of Rivers
A. Plantain Garden
B. Rio Grande
C. Buff Bay River
D Agua Alta
E Rio Nuevo
F White River
G Rio Bueno
H Martha Brae
I Montago R
J Great R
K Lucea R
L Cabritta R
M Black R
N. Milk River
O. Rio Minho
P. Boddles Gully & Salt River
Q Rio Cobre
R Cane or Falls R.
S. Yallahs
T Morant & Johnson Rivers

Lecture on "Mining in Jamaica."

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RETROSPECTS AND [illegible]

BEING A SEQUEL [illegible]
in Kingston, Ja[illegible]
Lecture was given [illegible]
the Governors of "The Jamaica Ins[illegible]
at the M[illegible] Institute [illegible]
Shrove Tuesday.

Mr. Chairman, Ladies [illegible]

Part 1st. [illegible] night is Retrospect[illegible] may prove [illegible] the first [illegible] amusing; although [illegible] some slight degree [illegible] rather be the latter [illegible] perhaps not be [illegible] and the "joint" [illegible] thus become at [illegible] signal right [illegible] a method of address[illegible] occupation [illegible] my Lecture [illegible] apply [illegible] of them [illegible] there lived a[illegible] His four elder [illegible] world for them [illegible] or had [illegible] Bithynian [illegible] youngest son [illegible] guard and keep [illegible] "plethra," [illegible] tive examination [illegible] for our [illegible] now addressing [illegible] or of Law; [illegible] which, by the [illegible] take [illegible] *once proceed to* [illegible] Theban glory, [illegible] accounted as the H[illegible]

Lecture on "Mining in Jamaica."

RETROSPECTS AND PROSPECTS.

BEING A SEQUEL TO A LECTURE PREVIOUSLY GIVEN (FEBY. 6TH, 1889,) IN KINGSTON, (JA.,) ON "THE GEOLOGY OF JAMAICA." THIS SECOND LECTURE WAS GIVEN, LIKE THE FIRST, UNDER THE AUSPICES OF THE GOVERNORS OF "THE JAMAICA INSTITUTE," AND WAS DELIVERED AT THE MICO INSTITUTION, KINGSTON, (JA.,) ON 5TH MARCH, 1889. (SHROVE TUESDAY.)

MR. CHAIRMAN, LADIES AND GENTLEMEN,

PART 1ST—INTRODUCTION—SECTION (*a*.)—My selected subject to-night is RETROSPECTS and PROSPECTS of MINING IN JAMAICA. As it may prove, here and there, to be rather a dry and dull theme; let me, at the first onset upon your patience, endeavour at least to be a little amusing; although I should not like to end, without having been also, (in some slight degree,) instructive. Indeed, (to be candid,) I would myself rather be the latter chiefly, than the former only; nevertheless, it may perhaps not be impossible to combine them—so to mix the "powder" and the "jam"—that the ingredients may blend and harmonize, and thus become at once palatable and tonic. I certainly have no professional right to use this medical metaphor, and therefore I will now adopt a method of address which is more within my province. Being, then, by occupation a preacher, I trust I may assume permission to commence my Lecture with a parable. In ancient Bœotia, or pre-Christian Cappadocia, (where men were more valued for the size and strength of their limbs, than for the range, depth, or acuteness of their intellects;) there lived an old man, who had five sons, and one maiden daughter. His four elder male offspring—grown to manhood—had gone into the world for themselves, had settled as tradesmen or mechanics in towns; or had (by attraction, or by conscription) been drawn into Theban or Bithynian wars. The daughter, on the verge of womanhood, and the youngest son—a lad—were left with their aged and feeble father to guard and keep the paternal homestead, and to till the ancestral "plethra," (or as we should now say, acres.) In these days of competitive examinations, not only for our stouter and stronger boys, but also for our maidens, slim and fair; when therefore I may, perchance, be now addressing several Spinsters of Arts and Doctresses of Medicine or of Law; (ladies, I believe, do not yet graduate in Theology—which, by the way, one would suppose that they would more naturally take to;) I need not remind *any* of my audience, and *therefore shall at once proceed to remind all*, that, (despite those twin sons, or s-u-n-s of Theban glory, Pelopidas and Epaminondas), the Bœotians were ever accounted as the Hodges and Chaw—bacons of classic Greece; and the

Greeks proper (Attics and Ionians alike) had a general belief about their Eastern neighbours the Cappadocians, that has come down to us in the form of a fossilized joke; which (again by the way) a Grub street scribe of the XVIIIth Century of our era, (one "Goldsmith") first *stole*, and then thrust into the mouth of a mad dog, and suffocated it thereby; although he gives another cause of the extinction, as follows:

> But soon the wonder came to light
> That show'd the rogues they lied,
> The *man* recovered of the bite
> The *dog* it was that died!
> —See *Vicar of Wakefield*, chap. xvii.

The original story, however, (which I would thus translate), was, that when a viper incautiously bit a Cappadocian—

> Unhurt survived the sluggish man;
> The fangèd snake of *dullness* died!*

Our old man, despite this proverb, was esteemed (for a Bœotian or Cappadocian, at any rate) as passing for wise, if even not surpassingly so, and at one time he had been known to be wealthy (as wealth was estimated in his humble rank and class of life;) but in his age, deserted by most or all of his stronger children, he had apparently become poor. The land, which (like many Jamaican owners) he *held*, rather than utilized, was, by appearance, inherently sterile, and superficially and manifestly barren, and covered with stones. It was but on a corner of it, in a modest cabin, with a small garden surrounding it, that the old man, his daughter and youngest son, contrived to subsist. Naturally under these circumstances he was still deemed wealthy, and by most of those who knew him, or had heard of him, was set down as an old miser, with a hoarded treasure; and his elder sons, to a man, shared in this belief. Therefore when they were. at length all gathered round the bed of their dying father, the eldest son (with the consent of his adult brothers) urged the old man to convey to them, with the last paternal blessing, the information as to the exact spot where the hidden treasure was buried, either within the cottage itself, or in the neighbouring land. The dying man either from displeasure or surprise, seemed, at first, disinclined to accede to this request; although he did not altogether deny the existence of such a treasure. At last on being again earnestly solicited, he addressed his assembled family, with a feeble voice, but in a collected manner, somewhat as follows:—"You are right in thinking that there *is* a treasure hidden in "our fallow, ruinate, and stone-strewn acres; but you are wrong in supposing that *I* placed it there, or that I know precisely where, or "*what* it is; only it has been revealed to me by the gods *that it is* "*there!* Search for it and you will assuredly find it, if you only dig "*long* enough; nor need you, I think, dig very deeply. I would "advise you to go gradually, steadily and regularly over all the old "fields; rather than to spend all your time and strength on one spot; "and if you will all keep together in good fellowship, and work "together helpfully, you will lighten and also quicken your labours. "And, further, as you will have to live in the meantime, it will be as "well, that you four elder ones, as you turn over the stones on the "waste lands, should remove them, and make of them boundary walls "and dividing fences. You should also sow grain, and plant roots of "various sorts, to keep you well fed, after present supplies are exhausted, and existing resources prove insufficient: for the small supply of grain, and other provision now stored in the cottage, or "remaining in the garden for winter supply, (and which would have "been sufficient for some months to come, when the consumers were "only *three*, an old man, a girl and a lad,) will not last even half so long "when—although I shall myself be removed—the family, by the presence of you four elder ones, will be increased to six. Your sister "Prothumia will, as heretofore, mind the house, and the lad Microtatos "will continue to care and crop the garden. I stipulate therefore, "that when the treasure *is* found, that you elder ones, the girl and "the lad shall all share in it *equally*. It must, if portable and divisible, be made into six equal portions, or if not capable of division, it "must in some way be utilized, or disposed of, so as to secure the rights "and benefits of each and of all,"

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* "Vipera Cappadocem nocitura momordit, at illa
Gustato periit sanguine Cappadocis,"

is an old Latin rendering from the Greek Anthology—on which original I cannot just now readily lay my hands:—Byron also has the same idea, (for all the poets are thieves, they first pick our brains for us, and then surprise us with our own thoughts, reset.)

> "Down to the dust, and as thou rott'st away,
> E'en worms shall perish on thy poisonous clay."
> —A Sketch "Born in a Garret," &c., &c.

All this introduction is, doubtless, a digression; but it is a digression with a purpose, which, I trust, will both develop and justify itself, as we go along.

(*b.*) Some few days after pronouncing this nuncupatory will, the old man died, and the elder sons were content to test their father's vaticinations. They therefore delved and ditched; they furrowed and drained; they cleared and cleaned, and fenced the fields; and as they dug, they planted, and as they sowed, so after some time, they duly reaped. But that chest of golden darics,* or vase of pearls, or precious stones, they ever and daily hoped to find, never *turned up!* At last (on a day) they broke into an old tomb, but found nothing therein, save some human bones, and a few rusty antique weapons. Upon this, wearied and disappointed by their bootless search, the four elder brothers a day or two after, said to their sister, "We are tired of this "life of sordid toil. We begin to think our father was deceived. We "begin even to fear that he deceived us, with a view of keeping us to "protect you and the lad. We shall either never discover this trea-

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* The daric was a Persian gold coin. It was said that the Persians could not conquer the Greeks with *steel*; but did so with *gold*.

“sure, or there is really, NO treasure here worth discovering: give us “what money there is in the house, the fruit of our labours, and we “will take as much grain with us as we can remove, and we will be “gone. You and the lad—(he is not so *very* little now, and you had “better change his name)—can hold and care the place, as you did in our “father's declining days; and when we have made our fortunes, we “will come back and share them with you, as our father desired us to “do.” To whom the maiden—(who had inherited some of her father's wisdom and to whom, perchance, had been bequeathed her father's secret counsel and intention)—said—“Stay! brothers, yet a while, look “round and contrast those smiling fields—those well-stored shelves “and sheds—that bag of “drachmai” you allude to, the surplus profit “on your toils;—contrast, I say, all these, with the gloom of all ***without*** “and with the penury of all *within* upon the day on which our father “died; as our ***six*** feeble hands had not been able to till and crop the “land, when your *eight* strong arms were absent. And you, too, how “did you fare away from home; since you returned to us, so lean and “gaunt and hungry-looking, and without an *owl*, or even an obolus among “you”? (I interrupt the maiden's speech, as I shall have to refer to these “owls” again,[*] to say that the *bruas* or *buas* was an Athenian silver coin, stamped with an owl, the bird of Pallas or Athene, the patron goddess of Athens. These coins became of world-wide circulation, like a modern British sovereign.—The maiden thus continued) “Are you “not now strong and well-fed, warmly clad, and sufficiently housed? “The buried treasure has not appeared in any *one* spot, but, methinks, “I see it richly spread over all the fields. In truth the treasure ***has*** “***been*** found. *The land is itself the treasure,* and it is broad and wide “enough to give us each our heritage. O! brothers mine:—the father's “word is true to us to-day; and now I claim my ***sixth*** as wedding portion, “for neighbour Agathos has long sought me, and shall now win and “claim me as his bride!”

(*c.*) Such, then, is my introductory parable. The interpretation thereof may be given at once; the application and moral—not so brief—will be, in a measure at least, used as a leaven, and, if need be, corrective to the subjects of this lecture. Jamaica (as you have already perceived) is the ancestral field; one of the oldest of the British Colonies at least. The four elder brothers—(parables must not be too closely pressed as to the application of their details)—these four brothers may, however, stand for (*a*) the absentee West Indian proprietor, (*b*) the British capitalist, (*c*) the European or American merchant, and (*d*) the Cosmopolitan man of Arts, Science, and Literature. The impoverished and disheartened resident planters and local men in trade are the analogues (roughly speaking) of the maiden and the lad. Permit me *pro hac vice* to pose as the wise old man, (especially as I have studiously qualified his wisdom by acknowledging that he was a Bœotian, or worse still, a Cappadocian). “As to who Agathos may be?” Well I am by no means sure, as to the individuality of Agathos, and we may perhaps best let him pass as a parabolic lay figure, or dramatic supernumerary. But if I were called on imperatively, to round off my parable; then I would say: I bid you see and accept as Agathos, that brave, wise and good man (whoever he may be,) whether past, present or future Governor of this Island, English Colonial Minister—Elected or Official Member of our Legislature, or talented son of Jamaica; (whoever, I repeat, he may prove to be;) who shall be so gifted, at once, with political foresight, social wisdom, and local experience; that he may be able to resuscitate the hopes, rekindle the energies, and restore the fortunes of this island.

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[*] See part IV. (Prospects) sect. *t*, (note to) on the silver mines of Laurium.

(*d.*) How he may do these, is not within my power, nor does it properly come within my present province to attempt, at any length, to prognosticate, or conjecture. Let us hope, however, that *the man* and the *hour* are coming, and *are near*; if not already present with us. His forerunners, at least, are, I think, among us; when we see what is being attempted alike by the Governors *above*, and by the governed around us. Whether the good times coming will be just what we now hope, expect, and are striving for, *is as it may be.* If some few are more sanguine than they ought to be; many, very many are far less so than they might reasonably now become. Reciprocity treaties will do us great good, if at once, we can secure cheap breadstuffs and salt provisions from British Canada, and from alien lands, say the United States; without cutting us off from, or weakening our direct English connection; and also without shutting out our fruits, and other minor products from any natural or accessible, although foreign market. But all this seems to some of us very like wishing to have one's cake, and to eat it also. Imperial Federation, for the greater provinces of the British Empire, and Colonial Institutes for the lesser ones, may perchance have hidden in them *now*—and when they can develop and formulate themselves, may make patent, some germs of Jubilee goodness, even for us in Jamaica. Or our people, of all social grades, may be raised swiftly, yet surely and safely, by some educational necromancy, to higher levels of industrial energy, and lawful personal ambition; or at least, generally, may learn better applications of physical power, and more scientific adaptations of natural wealth; than those to which we have (any of us) as yet in Jamaica attained. Or perhaps the good times will come, when the very best fiscal regulations, in regard to the adjustment of revenue and *judicious* expenditure (which last is wise economy), will have created such local and general confidence in the stability and healthiness of our financial condition and prospects, that British capitalists, and American or other syndicates will be ready, with or without governmental guarantees, to invest their millions in the soil of Jamaica; either for Agricultural pursuits; or (if improved geological knowledge, and wider local investigation and experience will justify it), even in our now neglected marble quarries, and discarded and discredited copper and lead mines. Or lastly, collectively and commercially, in improving harbours, draining swamps, supplying lighthouses, building substantial wharves, and furnishing floating or graving docks, and starting grand hotel companies : or in laying down railways and tramways all over the island; and finding the sources, and also the resources and returns, which will make all these local improvements *pay*, (alike, and all at once) the projectors and shareholders—the staple producers and distributors; and also prevent too great a burden of debt being laid on the shoulders of that modern Atlas, *the public taxpayer!* So that by the time the Panama Canal *is* finished, (as finished, some way and some day, it now most assuredly will be), and when we have (as we probably shall have, in less than 20 years from this) *a million of souls* in Jamaica; then this city of Kingston will be able justly to re-assume her ancient mercantile position, as the "Tyre of the West"; and the island of Jamaica be again recognized by friends and rivals alike, as once more worthy of the proud title of the "Pearl of the Antilles."*

(*e*.) It will be seen, both in my parable; not wholly original—as my critics would soon discover,† and also in the somewhat sanguine horoscope with which I have concluded my interpretation of it, that I have modestly given, but a tertiary or quaternary place to the whole science of Geology, and to any local applications of the various branches of the arts of Metallurgy and Mineralogy; and I at once say that I have done so, because I have not in truth any brilliant theories or startling revelations to lay before my hearers (or readers) on these subjects as connected (at present) with Jamaica. I cannot promise assuredly, or predict confidently, that her mineral resources will be a very prominent or certain factor in her future prosperity; and I fear and know that the subject of this lecture, "Past and Future Mining in Jamaica," has in it a promise to many, who will think it wholly unfulfilled by me, unless I can (in certain localities of our island) at once point to the exact spots, where mines of silver, gold and precious stones, or at least, quarries of copper, lead and coal, can be immediately opened out, and made to yield up abundantly their hidden treasures. As I do not profess to be able at once to do this, my lecture will from first to last adopt, if not quite a pessimistic, yet at least a cautious and apologetic tone and character. It has been said "Woe to the man who says all he knows;" but a worse fate surely lies in wait for him, who says all that he *believes, but does not know.* I shall, therefore, say *less* on my subject than I believe, and shall confine myself to what I *know* as much as I can; at any rate I will only ask *you* to believe, what I can prove, or give proper and sufficient authority for alleging. I shall rather strive to justify and encourage the local study of practical geology, than to attempt to show that I am myself very well versed, even theoretically, in the special and local adaptations of this science, as applied to *metals* proper; indeed, I shall less strive in a positive manner to give definite information and dogmatic guidance, as to what we may confidently expect to obtain, with profit from the depths of our soil; than in a moderate and explanatory way to point to what *has already* been yielded in metals from mines in Jamaica now closed; and also in a cautious—not to say, cautionary—spirit state what, I think, we have little reason to hope for, on present scientific data, or at most and at best, what only by a happy stroke of good fortune, we may light upon. If between those two limits, of speculation on the one hand and caution on the other, I can mark out a pathway, bounded by the wall of certainty on the *right* hand, and by the gentle slope of moral probability on the *left*; then I shall have sufficiently effected the purpose I have set before me, in venturing, for a second time, to stand before you as a lecturer on theoretic and applied science. And lest I send any home to-night under the impression that I have made a promise to the ear, but broken it to the hope; I beg at once, to point out that the formal title of this lecture (as to the future) is a neutral one, and pledges me to nothing before hand (as to), whether the prospects are good or bad, encouraging or forbidding; and I at once therefore announce that I shall say little or nothing to inflame the imagination of sanguine local enthusiasts (if there be any), or to countenance the schemes of would-be scrip speculators and mining—share manipulators; whom any general and premature belief in local mineral wealth, would very soon induce to find their way to this Island. The effect of such incursion would probably be, (as it has been before in Jamaica, and elsewhere,) wherever speculation went far ahead of science and local knowledge; (See lecture 1st, on Geology of Jamaica, part II, sect. *f.*) —the effect, I say, would probably be totally, for another generation or two, to discredit the reputation, and to retard the development of such mineral and metallic resources as this island may be gradually and eventually shown really to possess.

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* According to Mr. Froude, the Antilles are the Ante-isles, (now called the Windward and Leeward Islands) guarding (as it were) the four larger Islands, Porto Rico and Jamaica—St. Domingo and Cuba.

† See, however, an article on "Literary Plagiarism" by Andrew Lang in the *Contemporary Review* of June, 1887, which is cautionary, but on the whole very consolatory reading for a gleaner and general "conveyer" of little known trifles of ancient and mediæval lore. Only I don't see that Mr. Lang quotes (as he should have done) the malediction; "*Pereant qui ante nos, nostra bona dixerunt.*" See also Emerson on "Quotation and Originality," also his article on "Shakespeare, or the Poet," wherein he shews (on the authority of Malone) that in three of his (Shakespeare's) historical plays "out of 6,043 lines, 1771 were written by some author preceding Shakespeare; 2,373 by him, on the foundation laid by his predecessors, and 1899 were entirely his own." So then "*The originals are not original.*" The sayings of the seven sages were all said before them. Most of the "Pearls of History" are "*Mock-pearls*;" and what the Preacher said, is true (as of many other things, so also of wise-saws and witty sayings) "There is no new thing under the sun."—(Eccles. i. 9.)

PART 2ND—ASPECTS (*a.*)—I should like to have called my present lecture Retrospects, Aspects and Prospects of Mining in Jamaica; but as to the middle term I have had to omit it wholly from my epigraph or programme; nevertheless as an aid to the interpretation of the past, and as a ground of prognostication for the future, I must give a brief division to the intermediate and existing period; or at least act, on the principle adopted, and precedent set by that German naturalist, who, once, was writing a ponderous book, on the terrestrial distribution of the Ophidian, or Serpent genus of reptiles; and therefore has a brief chapter, which without wasting much time, I can quote verbatim, as follows: "On the snakes of Iceland." "There are *no* snakes in Iceland:"* and so both begins and ends the chapter. In like manner I might say of the *aspects* of mining in Jamaica, that there are *none* such, at present, visible or existent: I cannot, however, let *you* (or for the matter of that—*myself*) off on this tópic, in that succinct and summary way. I know I have apparently a bad case in hand: as the "bobby" said to the "beak" of the culprit in the police court.—"Five previous convictions, your worship, and always drunk and disorderly when he's at large;"—to which you will think it, but a poor set off, to oppose what the prison-warder said to the visiting justice of the same party—"Quiet as a lamb he is, your honour, and that attentive to the chapling's sarment on Sundays, as you would'nt believe, if you did'nt know." And I, as the advocate for the defence, can neither at present, very ready produce sufficient evidence to secure my client an acquittal; nor have I any desire to snatch a present favourable verdict, which may be reversed by opposing counsel, on a writ for a new trial, or by appeal to a higher tribunal. I have only a few typical metallic specimens, on the table before me, to shew you, and some very modest and crudely devised diagrams with which to illustrate my subject. I shall not be able to perform any striking and demonstrative experiments. In these respects less happy than the talented and amiable lecturer, who last under the auspices of the Jamaica Institute—addressed an appreciative audience on such *attractive* and *striking* subjects as "Lightning and Lightning rods."† It has been said of old, that *masculine* humanity is attracted by its possession of the faculty of *sight*; but that "lovely woman" from her fore-mother Eve, even to this day, must be *caught by the ear*. Dr. Mayner "beat the record", for he caught both sexes, alike through sight and hearing; but then he had in regard to sight, an attraction about him, to which, I believe, even the ladies are not wholly indifferent, when placed in that position themselves; he was, at times, surrounded by "*sparks!*" Whereas, I being without any such adjuncts, must, therefore, just throw myself wholly on your patience and clemency, in making an attempt, which I must confess, (now that I have come to the pinch of it) looks even to myself more and more like hoping to get an empty sack to stand upright, or "making a silk purse out of a sow's ear."

(*b.*) Considering I was not forced to undertake my present task; many of you may be inclined to use to me Lord Melbourne's query, when people sought to bother him about such trifles as "Roman Catholic Emancipation", "Free-trade" and the "Extension of the Franchise,"

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* I find that I am wrong: the work is not on snakes. It is Horrebow's "Natural History of Iceland" and the famous chapter is chap. LXXII.

† Dr. Mayner's was the second lecture of the Fifth Series of these Jamaica Institute popular addresses, and was given on Wednesday evening, February 20th, 1889.

"Why can't you let it alone ?" Well, my reply is something like the answer Lord Melbourne himself got more than once, and had occasionally to see the force of. The matter will not let *me* alone. It has bothered me on and off, for 20 years or more ; and I am also like a widow lady with a property, (I mean the widow lady had the property referred to, not I), with whom I was slightly acquainted when I was a young parson, more than 30 years ago ; indeed it fell to my office to marry her to a second husband : the latter rather a loose fish I fear. I was told by an old lady, one of her friends, and also one of mine, that when she heard a rumour of Mrs. A.'s intended second marriage, she went to warn her, or to expostulate with her on her risk and folly, in entering on the matrimonial venture again, (and such a marriage !) especially as she had enough to live upon. When our mutual friend got some such answer as this, "Well, "he is always coming here : I have tried all I can to get rid of him, but I "can't, it's no use ; he is so persistent, and as people are—well—beginning "to talk about it, I am afraid of spiteful things being said, and so I only "see one way out of the difficulty, and *that is to marry him.*" There is likewise, only one way out of my difficulty about mining in Jamaica, and that is publicly to espouse the subject of it. Indeed, (if it be not bigamy for me, as otherwise a married man, to say so) I am wedded to it already. But I am well aware that few others will see this Siren, or Circe, with the eyes that I do ; and so to make the first parallel, or oblique approach to the citadel, alike of your sympathy and judgment, allow me to say, that I think it is a great mistake in us, as a people, at present to disregard mining matters in Jamaica altogether, as beneath our wise contempt, or as dangerous to our commercial morality and agricultural repute ; and that is about the state of public opinion at present as to the sanity of past mining enterprizes, and the practicability of future ones in Jamaica.

(*c.*) If we had in Kingston a comic illustrated newspaper, I should have expected, when a lecture on "Mining in Jamaica" was publicly announced, to have seen in this week's issue of our local "Punch" or "Fun"—a placard something like this.* For these clever prints, although they claim to lead and guide public opinion, in truth, nine cases out of ten, only follow it ; and some times even pander to that which is neither intellectually the highest, nor morally the best public opinion. However this might be, in the case I am now supposing : if (after this satirical caution given to you to-night, and by myself,) some of you should in the future too eagerly avail yourselves of any chance that may arise of burning your fingers with Jamaica mining shares ; *Mind, you don't go about, saying that I made you do it !*

(*d.*) The Museum of the Jamaica Institute is unfortunately, at present very poor in Jamaican *metallic* indications, and this absence of such specimens tends to deepen, *if possible*, the all but universal opinion that we have no metals of any use, or promise in Jamaica. I know that two very respectable collections have in past years been made here—one by the Old Royal Society of Arts of Jamaica, and the other by Mr. Sawkins and his colleagues in the Jamaican Geological Survey,—to send to England or France, for some of the many Universal Expositions that have been held in those two countries. To these exportations I myself contributed all my best metallic specimens.* What have become of these two collections, I cannot say; and I fear it is hopeless to attempt to trace and recover them; but I do say that the sooner we commence to make another collection in Jamaica, the better; and I think if the task were set about in earnest, that it would not prove so hopeless as it looks. But let me now confine myself a little longer to Aspects only, (though they may be negative ones solely.) The steady current of local, as well as of outside opinion, now runs continuously, that we have geologically *no true* metalliferous formations in Jamaica: that this island must ever remain a purely agricultural and pastoral country; or at least with only such manufacturing and manipulative industries, as will enable us to send the vegetable products of our soil to British, or foreign markets, in the most merchantable and competitive condition possible.

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* Here sundry copies of a placard were handed round, having a device of Death's-head and cross bones, in the middle, and with a motto above "1858. *Beware of Mining in Jamaica* ! 1858."—and below another "1888, *Metals is PISUN !* 1888."

(*e.*) Our local newspapers, however much they may differ from each other, as to our present prospects and future interests, are all agreed on *one* point. No editor in this island, however hard up for subjects to dissect, or for "copy" wherewith to stay the maws of his demoniacal "galley" slaves, would himself, at present, initiate the idea, or permit (even favoured) correspondents to suggest, in the columns of any daily, or even weekly issue; that perhaps—after all, capital, skill and energy might be wisely and profitably, if only scientifically and prudently, directed, at least to prospecting for metallic indications in Jamaica, or in following up such as are already known to exist. No elected member of the Legislature in the Council Chamber, and no candidate for senatorial honours would be, on the hustings, at present, so bold or rash as to propose that a grant of public money should be allotted for these purposes; nor would it, by the Government itself, be thought expedient (if our railway system is to be considerably extended and ramified) to have a practical mineralogist, or scientific geologist permanently attached to the staff of the Public Works Department; so as, *at once*, either to discover and duly appreciate all true "finds," or on the other hand, as readily to detect "mares-nests" and denounce "frauds"—should any of these be lighted upon, in making cuttings and driving tunnels. I am not surprised that nothing very noticeable was found, save some fossil sea-shells, in making the Porus and Ewarton lines; because their tracts pass chiefly over alluvium, or through deluvium, unconformable coast-limestone and upper tertiaries and marls. I *did* hear of a little gold quartz; but I have not seen it, or been able to verify the statement.

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* In pottering round the Jamaica Institute Museum, since this lecture was given, I see in a case of "odds and ends," two small pieces of "Job's Hill" copper ore, labelled as having been given by me. The percentage of copper, marked, is as high as 72 per cent.! I did not give this, although I knew that it is very good ore. I have recently learnt that Mr. Bowrey, the Island Chemist, did on analysis, find this percentage. However, 10 *per cent. will pay*, as I shall show in the sequel.

(*f.*) Mr. Morris, who (as Director of the Government Plantations and Island Botanist) was so useful, and also deservedly popular here, was, when he first came to the island, rather sanguine of the metallic, or at least of the mineral resources generally of Jamaica; but he has since changed his views, and adopted another, and less encouraging tone. In his able lecture before the London Chamber of Commerce, delivered 27th March, 1888, "On the Vegetable Resources of the West Indies," he says "the *mineral* resources of the West Indies appear to be comparatively unimportant." This opinion of Mr. Morris I own to be a weighty one; still it is itself cautiously, and not dogmatically worded; and if I presume to plead for some further modification of it, or even reconsideration, it is because I have had very wide and lengthened, and somewhat minute experience of many localities in Jamaica; taking in *space*, indeed, nearly the whole island, and extending *in time* to forty years. I say then if I differ—with deference and respect—from Mr. Morris, as to his estimate of the importance of the mineral resources of Jamaica; I do so, because, I venture, but with humility, to put my long, close, and varied local experience, as some slight reciprocal or set-off to his far superior scientific training, and much wider, or even cosmopolitan experience.

(*g.*) It does not follow, that because Jamaica is an agricultural country, that she can never be either a seat of mining, or of manufacturing development. England itself is pre-eminently all three of these: and likewise it does not follow that because mining has heretofore failed in Jamaica that it always will fail. You remember the story of Bruce and the spider; and there is a far older, (indeed two old stories)—contrary in circumstances to the Bruce anecdote; but, as I think, the same in moral:—of which, in concluding what I have to say about *Aspects*, I will here remind you. But I will direct my moral first, —"When in doubt, abstain," is a good dietetic rule; and many will think appertains very specially to mining. I should now say on these Jamaican mining *Aspects* "When in doubt, *inquire*—while you are abstaining." To mining, doubtless, still more properly applies another current caution; "not to prophecy, until you *know*." Some of you, then, may before this have heard of the incident in classic lore, of an ancient wise Greek philosopher, who when asked, "what sort of ship was safest to "sail in—one long, narrow and deep, or another short, broad and shallow?" replied "The only *safe* ship that I know of, is the ship *that is drawn up high and dry upon the shore!*

(*h.*) English, and even Greek seamen would consider that this speech of the ancient philosopher was, but that of a land-lubber. But I think the sage only meant to say, that there is no such thing as perfect safety on the voyage of life. We cannot, in truth, build for ourselves now, towers of security, any more safely, than they did at Babel of yore: the Eiffel Tower will not be *quite* safe, indeed many think it will be very unsafe. And so, I suppose, if nine really wise men[*] out of ten in Jamaica, be asked of the old mines here, now closed, *which* of them it would be *safest* to re-open and invest in; they would reply (if not of *all* mines—all the world over) at least, of local ones; that the only *safe* mine, is the mine that *is closed and abandoned.* And yet on the other hand—(like the jack-tars, ancient and modern, to whom I have alluded)—I do not, myself, see much difference between this wise pessimism, and the foolish timidity illustrated by my second old story; which is indeed the Esopian anecdote of the ruined merchant, who had lost his all, (bark and cargo of dates) swallowed up by shipwreck. Walking, long afterwards with a young but prosperous friend near the sea shore, on a quiet, sunlit evening, the friend admiringly pointed out the beauty of the scene and the tranquility and transparency of the sea; but the ruined merchant would see no charm in those expansive waters; their many-twinkling wavelets seemed to him only as the smiles of a painted Phryné, and therefore he solemnly cautioned his enraptured companion against the treacherous wiles of the inconstant sea—"Beware," said he, "it is only waiting for the first opportunity to *swallow up all your dates!*"

PART 3RD—RETROSPECTS—SEC. (*a.*) We come now to a review of Mining Retrospects in regard to Jamaica. But on this point also, I have a few general remarks to make: indeed my subject is something like the city of Jericho, and must be compassed seven times, (or something like it) if a breach is to be made in its walls, and we as victors are to enter in and possess it. Although, then, in those branches of philosophy, which have a *moral* bearing or basis; which teach men how to live well, and to die bravely or trustfully; I doubt much, if we are *one bit* wiser than the ancients: or if we *have*, in fact advanced some little way beyond the standpoints of such eminent heathen moralists as Socrates, Plato and Aristotle; yet we have not fully attained to—much less advanced beyond—the ethical principles and tenets of Moses and the Founder of Christianity. Nevertheless, as to all human knowledge, which has a material basis and a strictly utilitarian and mundane end, it is progressive; and in regard to it, *one* part of the teaching of the Comtist or Positive philosophers may be sufficiently true; and this is, that all human mental knowledge and physical experience have passed, (or here and there in backward places, and with half-educated individuals are still passing) through *three* successive and advancing stages—the Theological, the Metaphysical, and the Mathematical—or, as I prefer to put them, 1st, the ignorant and superstitious phase; next, the speculative and *a priori* experimental stage, (*i.e.*, when men formed a theory *first*, and then brought or bent their facts to bolster it up); and thirdly and lastly, the deductive, experimental, and scientifically inductive stand-points, which are *now* the sole bases of all true material knowledge. Roughly speaking, we may class and call these three stages respectively, the Ancient, the Mediæval and the Modern. They represent three progressive ways of looking at thoughts and dealing with things: perhaps without the two first, the third would have been to us—ever impossible. Pardon me, but I am not digressing so much as at first you may suppose. All this applies as much as, or (as I think) rather *more* to Mining than to anything else. Mining has passed —all the world over—through the first and the second stages of these developments. It is only now, and in our day entering the third and highest stage of its progressions.

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[*] Since this was written, a public opinion has been indirectly expressed (by a son of Jamaica too) that wise men are nearly as scarce in his native country (*i.e.* Jamaica) as good ones were in the doomed Cities of the Plain.

(*b.*) All true material sciences, indeed, have had their origin, or at least, their pedigree from childlike and imaginative ancestors; from superstitious and, in a measure, fictitious or unphilosophic principles; or, at least, and at *best*, from tentative speculations and *a priori* hypotheses. Thus Astrology was the mother of Astronomy, Alchemy of Chemistry, Magic of Medicine, Poetry of Music and Grammar alike; and so in the same way Geomancy and Rhabdomancy are the ancient forefathers of Geology—(By the way I am told—I have not read of it myself—that just now, in the English *society* papers, there is some excitement going on, as the result of a recrudescence of Rhabdomancy. Some scientific Rip-Van Winkle has been amusing, or humbugging a wonder-loving public with water-finding divining rods and treasure-trove cross-staves).

(*c.*) All these archaic, that is, primitive and obsolete ideas, may now by us be considered, as only interesting and important in philosophic and historical aspects, and we may now in practice, let them severely alone, as wholly behind the age. But as to the past, (and even the not very distant past) we need not be surprised at its pre-scientific records. Theory (it *ought* certainly to be *sound* theory) is at the foundation of all good practice; just as true religious faith is the corner-stone of all real good works. It is, unfortunately, the case, however, that the *first* humanly devised theory is seldom *sound*, and the bases of popular faith are not always *true*; but then, neither is the first practice generally efficient, (even when the theory *is* sound) nor the *first* works, (even when founded upon a right creed) often worth much, beyond their laudable intention. But I have in the above remarks had my thoughts set, (as should *now* be the case) more on science than on theology.—Don't let us, then, from our present scientific standpoints, utterly condemn the worldly wisdom, or ridicule the mechanical toil and un-economic expenditure of our forefathers and predecessors; because they occasionally blundered in their practices, and were often egregiously wrong in their scientific theories: the wonder is they did not blunder more, and that they got such good results from such non-natural principles. Don't let us, I say, be surprised that men who were—all of them—even the wisest of them, in the superstitious, or at best in the experimental era of human knowledge, were not (as we are) in the scientific also. But on the other hand, don't let us refuse, ourselves to dig and delve in the Aladdin garden of science, because our predecessors had not the means of studying systematic arboriculture; indeed, were but groping round the roots of the tree of ***permissible*** scientific knowledge, (as in some things we are ourselves still doing) to find the easiest way to climb it, by hands and knees, (if no ladder could be got) and had (or have) not therefore yet gathered or tasted anything but its windfall or withered fruits;—had not (or have not) yet formulated the shapes of its leaves, or classified the family of its flowers, so as to determine to what class of edible, or useful plants it really belongs. In fact, the fault of these inquiring men of old was not that they were *behind* their time; but rather that they were (in theory at least) *long before it.* They assumed a great deal more than they knew, or could then possibly prove; but sometimes their *a priori* guesses, and pre-scientific and metaphysical conceits were not very far from what has since proved to be the truth. Animals are much stronger than they are aware of; or they would not (at least until firearms were invented) have shewn so much fear of man, or yielded themselves so easily to his dominancy, or so readily to his convenience and utilities. Likewise, as indeed Emerson says, "*Men are wiser than they know.*" Thus I may adduce that Thales of Miletus (640 B.C) taught the sphericity of the earth, and proclaimed that the moon received her light by reflection from the sun; and (according to Callimachus), Thales also determined, for the early Greek navigators, the fixed position, and consequent use of the Pole Star; by which the Phœnicians—even previously, had guided themselves on their distant voyages. It is on the other hand true that Anaxagoras, (500 B.C.) who was in many respects also a wise man, was somewhat short in his reckoning when he determined, (from his inner consciousness probably) that the sun might be somewhat bigger than Peloponnesus! But then to put my contention square again, I will adduce the testimony of Pythagoras (580 B.C.) who assumed, or tested the identity of the morning and evening stars, Hesperus and Vesperus; (whose dual masculine names, we long ago have changed for the single feminine name of Venus only) and Pythagoras also taught his inner school of chosen disciples, that the sun occupied the centre of the planetary Kosmos, and that the earth is but a planet revolving round the sun. It is a modern mistake to suppose that Copernicus (1473 A.D) discovered or invented this system. Philosophically the older Pythagorean astronomy was long known and taught, as the antithesis and opposite of the more popular, and to the later ages, apparently more credible system of the Ptolemaic school. The merit of Copernicus consists, (and it is no little merit) *in proving*—after one and twenty centuries, that Pythagoras was perfectly right, and in finally refuting the complicated and unscientific explanations, and in removing the geocentric standpoint of Ptolemy of Alexandria (70 A.D.), and putting the planetary system back once more to the heliocentric pivot of the Pythagoreans[*].

(*d.*) Various arts, too, were practised by the ancients, and mechancal appliances utilized, long before the Sciences on which they really rest, were studied, or even known. In a sense, however, we are all of us, as soon as we can begin to think and reason —Metaphysicians; and likewise, as soon as we attempt to utilize for any purpose the soil on which we tread, we begin to be mineralogists and geologists; most often without knowing that we are becoming such; until suddenly we find *that* out; just as Monsieur Jourdain, in Moliere's play of the Bourgeois Gentle-homme found out one day, that he had been talking *prose* all his life.

(*e.*) At one time I used to think that the patriarch Job was the first geologist; he was perhaps so in a philosophic sense: but he knew that before his time, men had come to be aware that "there is a vein for the silver and a place for gold" where the cunning seeker might find them;—that "iron was taken out of the earth, and brass is molten out of the stone" (chap. xxviii). In one respect, at least, I still think Job *ought* to rank as the patron saint of Geologists; inasmuch, as it is a science that needs a wonderful lot of *patience*; and that probably is the reason why prosy old fogies—like myself—take to it. But perhaps, you will think that the claims of the Abbé Galiani (born in Italy A.D. 1728 and nephew to the then Archbishop of Torento) are, on the whole, better than those of Job, to such saintship. I fear, however, the Abbé, in his life and morals, was *not* very saintly. Diderot describes Galiani, as a "treasure on rainy days, and if the cabinet-makers made such things, "nobody would be without one in the country." The point is, that when his uncle and patron the archbishop died, he (Galiani) was reduced to great straits. He, however, got the happy thought of sending to the Pope (Benedict XIV) a collection of the 141 different kinds of stones he had found on Mount Vesuvius ;[*] adding thereto a learned, and for that age a well written quasi-geological treatise, with this superscription somewhat (as you will see) altered from the Vulgate) "Beatissime Pater, dic ut mihi lapides isti panes fiant"—"*Most Holy Father command that these stones may, for me, be made bread!*" This prayer—(waving the antecedents, and the associations with the original speaker, (St. Matt. iv. 3) as well as the inversions of, and irreverences towards the Scriptural incident)—the Pope granted, by making the Abbé—(I am glad to say) neither a Canon nor a Bishop ; but by sending him as Secretary to the Papal Legation at Paris, where the Abbé became for some years a court celebrity. The collection of stones is, I believe, still to be seen in the Museum of the University of Bologna, to which the Pope presented it, with an endorsation of Galiani's request, that the study of Geology might be fostered. But it is high time that we get to purely Jamaican retrospects.

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[*] Pythagoras, although a mystic and metaphysician, nevertheless, as a geometrician, knew, and as a sworn secret taught to his elect, that "*the side of a square, is to its diagonal, as the number One is to the square root of the number Two.*" And from this principle his followers in his name ("*Ephee*" "The master said" ("lit. He was saying") was their standing dictum): he, then, or his followers were thus able to determine *relatively* the distance of the planet Venus from the sun on the one hand, and from the earth on the other, at conjunction; for it was observed that Venus was never more than 45 degrees—first east and then west of the sun, and that the sum of these (*i.e.* 90 degrees), gives the "right angle," made by the two sides of a square; therefore the side of that square (say x) was the distance of Venus from the sun, and then x plus difference (x plus d) was the diagonal of the square, and represented the distance of the Earth from the Sun. Thus dividing the distance of the earth from the sun into 25 parts: the distance of Venus from the Sun would be 18 of these parts; the distance of Venus from the Earth at conjunction, or transit, would be 7 of these parts. Relations, which modern Astronomy has pronounced to be very nearly correct, and we have now been able by other means and aids, to convert the *abstract* proportions into all but *actual* distances in space. And this illustration I think, represents fairly the agreements and contrasts *alike*, I, in the lecture, strove to point out, between *wise* ancient metaphysical theory, and modern practical science, and exact mathematics.

(*f*.) I will make the traditional and first historical part of the matter very short. You have all heard of the early Spanish occupation of the West Indies; (and as the fourth centenary of Columbus' achievements is approaching, we shall shortly (1892) hear much more of these past events,) and you are aware that the thirst for gold (naturally deposited) was (save perhaps with Columbus himself) the chief impelling cause of the first settlement and colonization of these islands by the Spaniards and others ; and also no small incitement to the subsequent invasion and conquest of many of them by Frenchmen and Englishmen ; although downright plunder was a still stonger incitement to all these European adventurers :—for in those days, European international treaties, and even the more humane principles of Christianity did not *hold good to the South of the Tropic of Cancer*. There are. however, still extant evidences, that the first European possessors of this island, and also at various times, some of their successors or supplanters, did honestly attempt washing our river sands for gold, and excavating our mountain slopes for copper and other metallic lodes ; and they did so with some little, if not with very signal success : our Rio Cobre and Rio d' Oro, our Hopes and Silver Hills—perhaps our Golden Groves and

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[*] Galiani was "wiser than he knew." At first thought he (and we) might have supposed that only Plutonic rocks would be found on Mount Vesuvius. But Phillips' "Manual of Geology" (Chas. Griffin & Co., Strand, London, 1885) page 179 (chap. XII. of part 1) has the following : "It is well known that the surface of "Vesuvius is covered with fragments of limestone, ejected from the throat of the "volcano, and many of these blocks are so little altered, that Professor Guiscardi "has been able to recognise several hundred species of shells in these masses. "We thus discover that deep beneath many volcanos, stratified rocks exist." *k. t. l.*—Indeed some geologists, from this and from some other evidence, are inclined to consider granite itself, (whether fundamental or intrusive) as merely an altered stratified rock, that is as metamorphosed sedimentary, baked but seldom fused. And if so, this would militate against an incandescent globe slowly cooling ; and thus would go far, if sufficiently substantiated, to upset Nebular Hypothesis altogether. See Lect. 1st. part IV, sec *h* (note) page 37 and *k* (5th) page 43. (note)

Lucky Valleys refer to other than Hesperidean fruits;—certainly do so—our Potosi, Mexico, and Peru. These last, at least, by their very names would seem to point to the hope, and quest for mineral treasure of various kinds. I am not forgetting my introductory Bœotian or Cappadocian parable—and so with this allusion to the names of some of our landed properties, I will now pass on, and come to the experience of men still living,—let me even come to my own experience.

(*g.*) Passing over then, all previous mining attempts; an effort in 1836 or 1838 was made (in which some members of my own family were interested) to develope the known cupriferous indications of Mount Vernon in the Port Royal Mountains, about 10 miles from Kingston; but although some money was sunk in the adventure, and much more thrown away in speculation on the rise of the value of land, and in share-scrip; yet nothing much came of it all. In 1850, or thereabouts, attempts were again made at Mount Vernon, and a regular shaft sunk, adits driven in the hill-side, a water wheel, pumping gear and a crushing machine erected, and at a great and *unnecessary* expense a lot of Cornish miners were imported. Two or three would have been sufficient; native hands could have more cheaply, and quite as efficiently, done all the manual labour. At this latter time—*i.e.* 1850 to '55—a wave of mining enterprise, or of excitement and infatuation (if you will) had passed over the whole island. These things seem to be epidemic now and then. They are in the air at times, and people catch them as they do measles and small-pox; and you might as well ask who invents the ladies' dress fashions as to try to get to the bottom, origin, and secret causes of a popular, but passing craze. And such mere crazes are, in effect, the most fatal detriments to all true scientific and social progress. But the following facts, in regard to the case in hand, may be alleged. First, two or three other mining companies were established; (I am not sure that of Mount Vernon was even the first) and soon *a dozen, two dozen, a dozen dozen.* other mining projects were started and promoted, and hundreds (literally so) of printed forms of mining leases were signed. Almost every land-holder in a promising district, down to the three and five acre settler had signed away his underground rights, to some mining company, or agent, or enterprising speculator. The island was in a very depressed, and worse still, in a very desponding condition, caused from the remaining reactions from Emancipation, and the surviving consequences of slavery, on whites and blacks alike: although in a reverse way—respectively. These evils had been intensified in their local effects by the abolition of the English navigation laws, and the repeal of differential duties on foreign imports to the British markets. (Parenthetically I may say, that sugar and other bounties were not thought by us such utter abominations—as they doubtless are—so long as our Jamaica sugar and coffee planters and pen-keepers benefited by them). In short, the full establishment of Free Trade in the British Isles was ruining Jamaica; (for a time at least: it is too fine a country to be ruined hopelessly by any thing short of continued Turkish mal-administration;) and mining enterprise was jumped at, as a possible resuscitator of our falling fortunes: just as a drowning man, (we are told) will catch at a straw.—Job's Hill mine in Metcalfe came very early to the front, first to fan the flame of excitement, and then to smother our mining enthusiasm by a collapse. A landslip after a flood revealed apparently a whole mountain of rich copper ore. It was quarrying work rather than mining. Job's Hill shares, therefore, went up to a fabulous premium. Three or four hundred tons of first class grey copper ore were easily extracted. Some specimens of this ore I gave to the two collections already mentioned this evening. But the mining experts were from the first suspicious of Job's Hill. There was no true lode, or it had "*bunched*", as it is technically called; and when this happens, miners fear a break in, or a total local discontinuance of the lode. Now this was just what *did* occur at Job's Hill, and it might have cost thousands of pounds to strike the lode again. Fancy a big sweet potato only partially underground, with a legion of rats gnawing at it as fast as they could, and you will have some idea of Job's Hill mine, as I saw it about 35 years ago. The big "bunch" dwindled away *at both ends*, and no more like it could be found in the immediate neighbourhood; and first a re-action, and then a panic set in, and Job's Hill was "*done for*," dragging down with it the reputation of many other mines, especially that of Sue River in its vicinity, which was also in operation.

In regard to the vegetable kingdom it would have been inferred by such sagacious animals as rats, that if they had found *one* big sweet potato, they would on diligent quest, be likely to find at least 2 or 3 more, not very far off, but such an inference, made by men seeking for mineral wealth under the soil, would not be quite so reasonable.

(*h.*) But mining in Jamaica might have survived even the collapse at Job's Hill, but for other causes, viz: scrip manipulation, both here and in England—reckless expenditure—ignorant adventure, and I fear, in some cases, not a little jobbery and down right peculation. Indeed, Charing Cross and Stamford Hill mines in Clarendon, (where there were undoubtedly well-marked copper lodes, with some fair percentage of gold* in some of the carbonate deposits and quartz reefs,) were carried on for some time longer; until at last it was necessary, from the incursion of water into the lower shafts and drives, either to invest much more capital, or to *abandon the mines.* Speaking roughly, the Jamaica shareholders (although the poorer men) were ready to continue and increase their risks: but as a rule the large English capitalists thought it best to "drop" what they had spent, rather than to risk anything more. Confidence in Jamaica's mines (*apparently, but not really*—with sufficient cause) was much shaken, and it was therefore determined to send out an experienced Cornish mining captain, to report on Stamford Hill and Charing Cross; and if possible, on other mines also in Jamaica. Mr. Jehu Hitchings therefore visited this island, and in the meantime mining was all but discontinued; or where still continued, it was limited as much as possible. One hundred tons, and more, of good dressed copper ore, worth at least £1,000, were abandoned at the bottom of one of these mines, for want of proper lifting and pumping power: from this latter cause the water increasingly got in and drowned the mine, and there a hundred fathoms deep that treasure rests until this day!

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* See Lecture I., part II., sec. *i*, page 14, and of *this* lecture, part IV., sec. *u*, (text and note.)

(*i.*) Before Mr. Hitchings arrived, a shrewd old gentleman of my kinship, (he was my son's grandfather) said there were 99 chances to *one*, that Mr. Hitchings *would* condemn the Jamaica mines. This "prophet of evil" had himself invested some capital in these adventures, and had previously expressed himself sanguine of eventual profits, and so to that time had held his shares through all advances, and despite all depressions of their value. He was asked *why* he had so suddenly and completed changed his opinions, or at least abandoned his expectations. His reply was to the following effect: "I have "recently been reading, in an old book, an anecdote about a great "comet, that caused much alarm in France, some time in the reign of "Louis XIV. As it was confidently predicted by some, and seriously "believed by many, that the comet would destroy the world, it was, "*at last*, resolved by the Government (to appease the people) that "a celebrated astronomer or astrologist, (and in those days there "was not thought to be much difference between them) should be con-"sulted; and he at once, therefore, applied himself to setting up his "siderial houses, and fixing the planetary conjunctions and oppositions, "and thus to cast his horoscopes; or else he did seriously attempt to "calculate mathematically, the actual orbit and ellipticity of the comet's "path, and its relation to the earth's course and position. But he "informed the officials that it would be sometime before his decision "could be given. As the popular excitement was very great, espe-"cially in Paris, and serious disturbances were feared, and also trade "and agriculture, in the meantime, much disturbed and impeded: the "chief minister of the day, Richelieu (or Mazarin)—went in person "to the astronomer, and urged him, *at once* to announce (for the sake "of public tranquility) that the comet *would not destroy the world.* "'For,' said the shrewd minister—'if you give the decision that the "'comet will *not* injure the earth, you will probably be *perfectly cor-*"'*rect*, and you will hereafter get much praise for your prompt, defi-"'nite, and re-assuring decision:—whereas on the other hand, should "'it unfortunately happen,—contrary to your prediction—that the "'comet *does* destroy the earth; then, at any rate, there will be no "'human beings left to upbraid you for your error; nor when you "'yourself share in the common catastrophe, will your last moments "'be imbittered with the fear that your name will be handed down "'to futurity, as that of an imposter; since these will be *no* posterity "'after such universal destruction!'"

(*j.*) My kinsman's ***inverse*** application of this story, proved all too true: I am not prepared to say that Mr. Jehu Hitchings was aware of this anecdote; or if even verbally unknown to him, that he was, from his shrewd Cornish blood, able naturally, although (as I have said) in an *inverse* way to apply its principles to the copper and other mines in Jamaica; but clearly, as his decision was beforehand agreed to, that it was to be *final*, he would act the part of a wise man, so to cast his judgment that in his generation, at least, no one would be able to disprove its correctness. Mr. Hitchings then. and thus gave the finishing stroke to mining adventure in Jamaica, for 30 years at least; and "douce mon!" if he be still living. I doubt not, he thinks that the fact that there are no mines at work in Jamaica, to this day, is a proof of how wise and right he was,—as he did—to damn them.—But when I come to speak of Prospects, I may have to refer to Mr. Jehu Hitchins again.

(*k.*) Further English capital being diverted from the then existing mines in Jamaica, local means could not be raised, even by those few who were still sanguine. Here I may, ladies and gentlemen, venture to name the hon. George Solomon—our chairman of this evening (cheers!) as one of these. He having been always and to this day still *is* ready to give his talents, his legislative and commercial experience, his business and social influence, and his capital to anything that offers a reasonable promise of developing the resources of Jamaica—his adopted country. The Charing Cross mine, for instance as I have already stated, needed more extensive and powerful pumping and other machinery to keep down the ever-increasing percolating waters, and to follow deeper, and to lift to the surface the ores of the visible improving copper lodes. And even after many other local shareholders were damped and disheartened, Mr. Solomon at his own cost chiefly, at least by his advances and credit, imported the necessary pumping machinery; but I believe, it never got further than the Kingston wharves, and was after the closing of the mines, reshipped, unused, to England, and sold there for about one-fifth of its original invoice cost, the loss falling chiefly on Mr. Solomon.

(*l.*) Mining enterprise in Jamaica. as the consequence of all this, came down by the run, like a collapsed parachute. There is rather a good story told about the rise and fall in Jamaica of mining speculation; which as it illustrates the revulsion and disgust, which are sure to follow injudicious adventures, and inexperienced monetary speculations, in regard both to technical and theoretic matters, I will now give you. It may have been slightly embellished in passing from hand to hand, and it is by such literal "tradition" that it came to me; but I have reason to think it is substantially true. It has indeed, been said that "every man is bound to leave a good story even better than he found it." I give "Robert Elsmere" (chap. iii) as my last authority for this aphorism; because, clearly, many a good story, by the misuse, or abuse of this principle. (at the hands of muffs and dullards) has been utterly spoilt and de-salified. I hope, I shall not muff this one. I have heard the name of the person chiefly concerned, and that it was a standing joke against, and a sore point with him, as long as he lived: for obvious reasons I still withhold that name; but there may be some half-dozen present, who know the story as well as I do. But, for the benefit of others, here it is. A merchant, or large storekeeper in Kingston having, during the mining mania, "gone in" heavily for securing specimens of copper ore, and obtaining mining leases, shipped a few barrels of samples carefully labelled for chemical, or blow-pipe analysis. But having got disgusted by losses on the mining shares he had dabbled in, the speculator determined to wash his hands of the whole matter. and sold his scrip for less than a song. Some little time afterwards. as he was moving out of one store into another, his clerk said to him " What shall we do with the mining leases, and " the barrels of duplicate copper specimens in hand?" Testily the merchant replied, " Oh! they are all utterly worthless; burn the—non- " celestial—papers, and get a dray and shoot all the—blank—blank— " rubbish into the sea." Both which were accordingly done. The merchant had previously sent to stop the analysis; but alas! the counter-order never seems to have got, in due time, to the right hands; for after some months, a technical report came out—accompanied, of course, by a long bill in two heavy figures. Most of the specimens were pronounced to be of low, or only moderate percentage; some few of fairly good quality; but there was *one* sample. (number 11, let us say—after our choice mango of that brand,) which was extra-ordinarily rich. giving some *ninety-five per cent. of smeltable copper!* The merchant winced at the two heavy figures of the analyst's bill; but with some slight misgiving, rung his bell at once for his clerk, and putting a bright face on it, said briskly. " Mr. Knibbs, knock off " with whatever you are doing, and search among the old dockets " for the memo book of those mining samples I sent to England some " 18 months ago and let me have it *at once*." To whom the astonished clerk replied: " Didn't you tell me, sir, to burn the papers, and " to pitch all the specimens into the sea? They're *all gone*, sir!" The merchant had to pay that analyst's bill: but to this day no one has been able to recall, or recover the site, on mountain high, or in valley fair, whence came that *ninety-five* per cent copper specimen—that unique metallic Number Eleven![*]

PART 4TH—PROSPECTS—SEC. (*a*.) At last we arrive at Mining *Prospects* in Jamaica. This fourth part resolves itself into two or three points. As the evidence on any *one* point bears also somewhat on, at least, one of the others, to save repetition, I will just state these points : but in my review of or reply to them, I shall lump them together. First, then, are there, from the evidences of the past sufficient signs that Jamaica possesses *any* natural metallic resources ? Are the indications of these sufficiently promising to justify further inquiry. research, and experiment in the matter ? Are there any applications of modern science, any present developments of commercial, manufactory, mechanical, and economic principles that may serve as factors to make the failures of past mining in Jamaica, the beacons and warnings, by which we can avoid such failures in the future ; or even the signs and guides—the agents and the implements, as it were, by which we can in the future attain to some measure of success and profit in Jamaica, by reopening some of our abandoned mines, and prospecting for, and testing fresh ones ? I propose to present some cumulative evidence, which I think, bears upon these points severally. or upon all of them collectively.

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[*] After Lord Rodney's great victory over the French under the Count de Grasse in 1782, boxes containing various seeds or plants of the mango, &c., were taken out of a French prize, as they were being carried from the South Seas to Martinique and Guadaloupe. Lord Rodney brought these seeds and plants to Jamaica. The box marked No. 11, turned out to contain the best variety of mango, and that kind has retained, in Jamaica, at least, the name " Number Eleven," or (in native vernacular) Number 'Leven, unto this day.

(*b.*) I have already spoken of myself, standing here to-night, as the defender of a suspected or accused person ; or even as the non-professional pleader—on a writ of *habeas corpus*—for a criminal, who has already been condemned, and consequently incarcerated, on the decree of a previous tribunal : a judgment, too, endorsed by the concurrence of general public opinion. Analogies, I confess, (like metaphors) are apt to be dangerous, to those who attempt to amplify them, or too closely to apply them. And further, in my previous lecture, on the Geology of Jamaica, I gave (part IV. secs. *b* and *c*) rather a long and alarming list of the necessary, or desirable qualifications of a modern geologist ; but I omitted to say, that he ought to be a sound *lawyer* also—I now see that he should be, at least, an experienced barrister—and better still, a notable Q. C. duly instructed by an able and popular solicitor. But as I only claim to be a half-inch geologist, so I bear the same proportion to a lawyer, that a tailor is. proverbially, said to bear to a man. Although the tailors have another way of expounding that apothegm, and adroitly turn it from a disparagement of themselves, into a compliment to their art ; inasmuch as it takes *nine* skilful tailors to dress an ordinary masculine human being properly, and so make a *Man* of him ! But to revert from this sartorial digression, (as I confess it to be) and return to the lawyers, on our road back to the geologists : some of my friends tell me, at times. that I *ought to* have been a lawyer ; but of course that is only a round-about and disguised way of hinting their opinion, that I am but a poor stick as a parson. And then, once more, and further still. had I been a lawyer, I should now be doing a very unusual, if not quite an unprofessional thing : for if I am to pose here to-night as a counsellor learned in the law, I have actually accepted a brief, *without any fee being marked on the back of it !* My client indeed is at present, too poor to fee counsel. and as his own mouth is shut, (he being, as it were, in the dock or jail already,) I appear as *amicus curiæ,* as having had the case for the defence put into my hands, by the Court itself, that justice may eventually be done in the premises to be set forth; and I then for the *second* time to-night, throw myself upon the impartiality and clemency of the present tribunal, and I hope I shall not overact my part, as most amateurs do, after they have recovered from stage-fright. So, as the children say, "Let us make-believe, and play at judge and jury, a little bit."

(*c.*) Now, your honour, and you, ladies and gentlemen of the jury, —(I anticipate legal progress a little; but I am quite sure that the time is not far distant when ladies will serve on juries—*if they wish to do so.* Most men have to do so, whether they wish it or not; but, logically or not, you, dear ladies, are, of course, quite right, morally, to claim *all* that belongs to mankind; and yet to retain exclusively *everything* that is peculiarly your own: since every woman is of the genus or species Man; but no man has any right, or claim on the privileges of the variety Woman: which syllogism seems—and *of course* consistently, to be at the foundation of the Woman's Rights movement.) ——To begin then again—Your honour, ladies and gentlemen of the jury, you are supposed to have heard and weighed the evidence against my client, and you have permitted me to review it, in a somewhat exculpatory manner: but I feel I cannot yet ask you for a verdict of discharge, (much less, for an award of heavy damages, for injuries to person, and defamation of character) on the negative terms, I have heretofore set forth, and so I wiil now take a further step in advance.

(*d.*) I think Mr. Jehu Hitchings is the most formidable witness against my present case: let me therefore. take him in hand, first. Unfortnnately, we cannot to-night, put him into the witness box, or produce his sworn evidence under a foreign commission; but you may ask—"Where is his official report?" That ladies and gentlemen is "just what I want to know," as Paddy—(who wanted "to be a gentleman") says in one of his national songs. I have never seen Mr. Hitchings' report—I want it produced. Surely some ex-director, or ex-shareholder in Jamaica may have retained a copy of it?—Despite the anecdote I have told, as to how some people most effectually got rid of their Jamaica mining property. I suggest that a copy of the missing report be procured, framed and glazed and hung up in the Jamaica Institute, by the side of Magna Charta, already there. So that if future experience endorse Mr. Hitchings' decisions, that a wreath of laurel may ever encircle them: but if, on the other hand, future experience refute them—Well, in that case—the report should *still* hang there, but with its face to the wall, and this motto on the back, then made the front of it—"Habet Deus suas horas, et—*moras!*"—(*God hath His hours and His——Delays!*)

(*e.*) But in the meantime, and until the opposing counsel produce Mr. Hitchings' report, and justify its terms in a sufficient sur-rebutter, I submit that the following contentions are sound in fact, and good in law. Mr. Hitchings was, doubtless, a competent and practical ***Cornish*** miner; but he was only acquainted with primary and secondary metallic deposits, as they are found in Cornwall and in Devonshire. With granite, as underlying Cambrian and Silurian rock, or with Devonian sandstone, he was doubtless well acquainted; but our Jamaican metamorphic, intrusive, and porphyrtic formations—in juxtaposition to Tertiary and Upper Cretaceous strata—were literally—*terræ incognitæ*—to the authorized mining inspector; indeed, as I have already stated in my previous lecture on the "Geology of Jamaica," the particular eras, or ages of our various strata:—(despite a hasty survey made by Sir Henry de la Beeche long before: when Geology as a science, was itself in its infancy, and it is not in its manhood yet)—of our local strata, I say, were all unknown, until the Government Geologists, Messrs. Barrett and Sawkins Brown, Lennox and Wall, settled that our mountain limestone is not Magnesian, but middle Tertiary, or Miocene, underlaid by the foraminiferous Eocene clays: this was not done until ten years after Mr Hitchings made his report. I allege therefore, that Mr. Jehu Hitchings was no geologist; as far as I know did not claim, or pretended to be such. He was, and only claimed to be a Cornish mining captain, and, as I said (in the sketchy "Speculative" division of my former lecture) in speaking in regard to mining matters "*Sine Geologia salus est nulla.*" Mr. Hitchings' surveys also, of the mines of Jamaica, were very few, and limited as to districts; and made, as I have shewn, under great drawbacks and discouragements; for the mines were out of working order, and for the most part full of water. He had wisely stipulated that his fee and expenses should be paid, regardless of his decision; and he had the Cornish virtue of knowing how to hold his tongue, while at his work; so no one got anything out of him, while he was in Jamaica. I do not doubt that his opinion was an *honest* one, *perhaps* it was *correct*; but I don't think so, and *I am quite sure* that it was made on wholly insufficient data; and I affirm this, despite what I have previously said, under the educational head of my first lecture, (part I sec. *d.*) about the *general* safety and correctness of the practical deductions of the technical expert, and the sagacious intuitions of the intelligent observer and studious theorist, ***provided only they be also logical and scientific.***

(*f.*) No wonder therefore that Mr. Hitchings' report has, from time to time, (although with bated breath) been doubted and disbelieved, although not openly disputed. Other experts, visiting Jamaica since, and having much wider experience geographically than Mr. Hitchings had, have demurred, at least in private, to his decisions. I said in my first lecture, that the Government Geological Report was not a Mining Company prospectus, and therefore left "*mining* in Jamaica" an open question. The general opinion of the few experts who have cursorily examined our copper lodes and leads, has not been as unfavourable as that of Mr. Jehu Hitchings; but then they have been men, whose experience has not been confined to the mineral deposits of Great Britain, or even of Europe and Northern America. Those, who had have inter-tropical, or southern experience are, I think, in reference to our Jamaican indications, better guides, than those who have had *no* such experience. It is evident, despite the caution used in the Government report, that Mr. Sawkins, who had had experience in South America and in Australia, of gold, copper, and lead mines, *on the whole* thought *well* of our Jamaican indications, *and he told me* and, I think, others also, *that he thought so.* It may be safer, and more prudent, (as I have done), to take Mr. Hitchings' report, as in possession of the situation; but it is an induction—(as I have said, and I hope, shewn)—based on very narrow grounds, and much can be said on the other side: for instance, on page 35 of the Government Geologist Report, published in 1869, Mr. Sawkins writes as follows—"The "veins in Portland, also in porphyry, were worked to a slight extent; "a few tons of rich produce" (copper ore) "were, however, exported. "An American from Connecticut obtained about eighty tons from "Providence and Rose Hill mines, of which no account is preserved; "it is supposed that the civil war in America prevented a resumption "of operations."

(*g.*) So far Mr. Sawkins—I would now suggest that it would be well, before any further *very extensive* mining adventures were attempted in this island; that our metallic formations in Jamaica generally, or specially, should be compared, as much as possible, with those of Cuba. To this time I have not heard of any sufficient information by which we could compare the Jamaican indications, (say of copper), with those that have been tested, and successfully worked in the mountains of St. Jago-de-Cuba, the nearest point of that large island to our shores. If I remember rightly, from what my father told me, who visited these celebrated "Cobre mines," more than 40 years ago, (and they are still in full operation. I believe) the work there was, at first, in most cases, quarrying rather than shaft-sinking or tunnel driving, and the lodes more than once gave out, and the mines were, for a time, abandoned, (just as in the case of Job's Hill); but they were taken up again, (as Job's Hill will probably be, and other mines in Jamaica) and after more than one failure, have proved at last sufficiently and permanently successful. And there are other districts in Cuba. where mining indications, apparently no better than ours, are looked upon, by native Cubans at least, as sources of future wealth. Mr. Froude evidently believes in these Cuban metallic resources, or mines of the future; and I suppose he would hardly carry underground his pessimism about all things Jamaican. which he has spread so thickly over the *surface* of our island. For, speaking about the mineral promises of Cuba. he has the following in chapter xix. of his "English in the West Indies." "They" (*i.e.* the Cubans) "say that they have hills of solid iron on "the island, and mountains of copper. with 50 per cent. of virgin- "copper in them. waiting for the Americans to develop, and likely, "I suppose, to wait a little longer. The present administration would "swallow up in taxation the profits of the most promising enterprise "that ever was undertaken: but the metals are there, and will come "one day into working."

(*h.*) We are all agreed that Jamaica is, at present, essentially an agricultural country; but the way I hear many people speak is, as if, *because* it is an agricultural country, *therefore* it can never be either the seat of manufacturing, or of mining industry. In my first lecture, I shewed, however. that with, or without the the aid of electricity, our permanent mountain water power is really as good a motive resource to us as half a dozen coal mines would be. Of the Charing Cross mine in Clarendon, on the same page 35 of the Geologist's Report, I have already quoted, Mr. Sawkins writes to the effect that "although "the veins did not attain to more than 18 inches in width," yet "the "concern might have been remunerative to private enterprise, as a "considerable amount of ore was extracted." And in the appendices to the book, (No. 3. page 292) there is a statement in detail, given of the copper ore shipped by "The Wheal Copper Company", extracted solely, "in proving Charing Cross mine to the 31st December, 1857," shewing that (say) 208 tons, sold in the English and American markets for £2,817. The highest price realized being £24 15/ per ton, and the lowest £9 2/9; the *mean* of these extremes is £16 18/, and the average of 208 tons, realizing £2,817, gives all round £13 1/3 per ton. So twist these figures as you will, if we compare their results with the gross returns that sugar and coffee, from Jamaica, have for some few years past been yielding, in the European and American markets, I think we shall. at present, be forced to the conclusion, that ' Mining in Jamaica" may not. after all, be *less* remunerative than are our present staple agricultural products. And further, that the investment of capital,—to be concentrated at, say, half a dozen seats of mining industry,—need not be larger, at most and at worst, than is, at present, the aggregated capital distributed to more than one hundred centres of sugar and coffee growth and fabrication. These latter industries. however. need not in any way be prejudiced; indeed, may rather be stimulated, by successful mining adventure. At any rate, the value of lands, within some miles of any "lucky" mine, will be most surely enhanced, and the local population quadrupled, or at the least doubled. Of course. I concede, that money may have been "dropped" in putting these samples of copper ore into the market. Mr. Sawkins says (page 35) "the expenses were very large, on account of the staff of officers employed"; but I don't think £2,817 a bad gross return for the *very first* sales, (from a new mining adventure, in a new mining country.) sold at public auction. or by private purchases, *on trial*, as it were: considering that the enterprise would necessarily require a large capital, and would not be expected to make *any return whatever* upon that capital, until at least, (to speak illustratively) the *shop* was *open, or the ship was launched!* But apart from all this theoretic reasoning, these 208 tons of valuable metallic produce from *one small and newly opened* mine in the parish of Clarendon, conclusively prove *one* of my contentions or assertions, namely that in Jamaica "*the copper is all there—and no mistake!*"

(*i.*) Herbert Spencer—(celebrity on his part, not undue familiarity on mine, causes me to drop, in his case, the conventional prenomen of Mister)—Herbert Spencer, in his 1st chapter on the study of "Sociology," has a passage of two pages, (longer than can be quoted here) and in *that*, he enumerates the factors "which determine one "simple phenomenon, as the price of a commodity, say cotton." The intricacy, and the variety of the contingencies, named by Mr. Spencer, are appalling, but the cotton manufacturer must continually consider, and solve them all, in working out his problem: if he is to hit the narrow line and margin between profit and loss—fortune and ruin. "See," says Herbert Spencer, "See then the enormous complication of "causes, which determine so simple a thing as the rise, or fall of a "farthing per pound in cotton, some months hence"—I trust it is not presumptuous for me to add to Mr. Spencer's remarks, by saying that at first sight, it seems much more probable of any average manfacturer, even with an adequate capital to commence this business, to say, that he is much more likely to become a bankrupt shortly, than a millionaiare eventually: yet the hope, or chance of becoming the latter, is quite sufficient to tempt many medium capitalists; despite the fact so many previous and like capitalists *have* become bankrupts in the same, or in like adventures. And it is hard to say, whether skill and energy—vigilance and experience unitedly, are always, in this contest, a sufficient match for those causes of misfortune, failure and ruin, that are utterly beyond the power of the manufacturer to forecast, or even foreseeing, to avert or provide against.

(*j*) Of course all this is rank pessimism, when applied to Commerce and Manufactures. But why it should *not be* pessimism, but sound political and social economy, when applied to other judicious and scientific enterprises, is more than I can say, or see. I would therefore crystallize my conclusions, on this point, into an apothegm, as follows: *Industry and frugality are the revenues of the farmer and mechanic: but foresight, judgment, and Decision are the virtues (and valours) of the capitalist and economist!*

(*k.*) But speaking more generally; others beside the cotton spinner have to strive "to pluck the flower, safety out of the nettle, danger"; to extract the honey stored in the hives, without being mortally wounded by the stings of the bees to be despoiled. There are, however, it must be confessed, and certainly so, *two* occupations, even more risky than cotton spinning; and these avocations are—first *Literature* and—second *Mining.* I would, therefore, not exhort our more intelligent and energetic youth, unadvisedly, lightly, or wantonly to rush into either of these adventures; nor would I incite their seniors to devote to either of them much personal labour, or inherited, or acquired capital, (if they happen to have either one, or the other of the latter,) until, at least, they can obtain the best professional advice, and the surest unprejudiced information, that is available; and even then I should say, "Place not all your eggs in one basket;" but in so speaking, I am referring more to Mining than Literature; for the latter is a jealous mistress, and will brook no rivals; and as *to her*—if you will be advised by me, and I have heard the Siren's song,—under no incitement or allurement, from within, or without—attempt authorship;—that is don't, out of your own brains, and as a creator, attempt to provide intellectual pabulum to feed, or stimulate the minds of other men: under any circumstances, shun and abjure literature, subjectively; it will ruin you, as surely as gambling or drink; and like as with these two last vices, so with literature, when you have once seriously taken to it, neither loss of fortune, of friends, nor yet of health, or *of all these at once*, will ever force you to give it up. But in regard to mining—(for those who have a little spare money to invest.)—I would repeat, (what I said in the same, or other words in my first lecture,) that the study of Geology will be preventive, rather than provocative of wild-cat mining speculation; and that after all *judicious* mining is as safe a pursuit as any other speculation: you can't expect *perfect security* in *speculation!* I quote the following, from the *Saturday Review* of May 7th, 1887, (page 622, col 2) "It is notorious that mining is one of the most risky of "all industries, and extreme risk implies very numerous losses; proba-"bly more miners lose, than gain by their mining adventures; but it "may be true, all the same, that the return yielded by mining to the "capital invested is quite as great as in any other business." In confirmation of this dual position of the "Saturday,"—the looking to the *right* and to the *left*—trying to see if "the game be worth the candle" —carefully counting the cost, and then boldly taking the risk, if you find, mathematically, that the odds in your favour *are 3 to* 2, (and in regard to Mining in Jamaica, they *are* as 5 against 2, at least). I say, this principle is further illustrated, by reference to another honorable, but in truth highly speculative profession, namely, that of a soldier. In an article on "War." by General Viscount Wolseley, in the January, (1889) number of the *Fortnightly*, (just to hand), he writes as follows: (page 11) "The man who taught me billiards impressed upon me, that "I should never attempt any stroke, upon the success of which I was "not prepared to bet 3 to 2; and so it is in war,* you should not wil-"lingly. and on ordinary occasion give battle.* unless you feel that the "odds are at least 3 to 2 in your favour. To eliminate all chances of "failure from war* is impossible. The smooth stone from the brook "may again destroy the giant, and disconcert his confident army." "When about to engage, you may have the utmost confidence "in yourself, and in the daring valour, and battle-training of your "men; but in your heart, you will acknowledge to yourself that

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* As Scholia on this extract, I would say— after the word "war"—wherever it occurs add, "and mining"—and with "give battle." bracket "buy mining shares."

"after all, the result must rest with the God of Battles." And I may further remind you, that it is not long ago, that Lord Wolseley, also told some cadets at an English Military College, that "the best "means of obtaining high distinction, and foremost position in the "British Army, would be to lose no possible opportunity of getting "themselves *shot!*" So that in these modern days of commercial, industrial, professional, and social pressure and competition, I think, we may read a new sense into Juvenal's well known line, without wholly reversing, or destroying its original meaning. He considered it a dishonour—(as it is)—for the sake of mere living, to lose the higher and better objects, or "*causes*" of life; "*Et propter vitam vivendi, perdere causas.*" But *we* now-a-days, must acknowledge that most men, (and not the worst of them) are being *forced* daily to risk, or at least, rapidly to wear out the springs, and to exhaust the sources of life, in *earning means to live.* But to come to the point:—the co-operative principle, and joint-stock Companies are, of course, the proper securities, against loss; and the best safeguards and correctives to risks for *all parties*, in regard to Life and Fire Insurances, and equally so in mining enterprises.

(*l.*) I would not then advise you; who have honoured me by your presence here to-night, "*An audience,*" (as Milton said,) "*fit, though few*:" I say, I would not so ill requite your kindness to me, as to urge you to put your "bottom dollar," (to use a gambling Yankeism) into future Jamaican mining ventures; but I would try to stimulate scientific study of, and patient experimental quest, into this "Speculative" side also of our Jamaican Geology:—I don't want, (as by a Mark Antony sort of speech,) to stir and rouse my present audience, forthwith to resolve itself, unanimously, into a joint stock Company "*The Wheal Sheba*"—"*Hyder Ragged. Esq., Chairman*"—to explore and rifle "King Solomon's mines," in Jamaica. But I have ventured to prepare a few rough diagrams, illustrative of the conditions under which mineral lodes in Jamaica are likely to present themselves; and I exhibit some enlarged sections from the Geological Survey, which I think also bear upon the point; and by comparing these, with the mining localities marked on the Geological Map, prepared by Messrs. Sawkins and Brown, (of which I also exhibit an enlargement, fig. No. 4): from these data, I say, that in my judgment, a few general and experimental canons might be laid down, for our future guidance in mining matters in Jamaica. The neglect of these. or of some such geological principles; or indeed the total ignorance of them, has, I think, done not a little in times past, (although not *quite* all.) to ruin our Jamaican mining enterprises.

(*m.*) In my lecture on the Geology of Jamaica, part IV. sec. *g*, (page 36) I referred as follows to a large number (Nos. 7 to 28) of the diagrams there shewn. "Some of these are also intended to explain various problems connected with our Jamaican "speculative" geology:" And I now pick out and re-exhibit two sets of them, for this purpose, (Nos. 7 to 12, and 13 to 17). The first sets of these two are sections, enlarged from the Geological Surveyors' diagrams of the parishes, (or districts)—(7) Portland—(8) St. John—(9) St. Andrew, —(10) Metcalfe—(11) St. Thomas-ye-Vale, and—(12) Port Royal Mountains. All these, as I said before, "illustrate the intrusion of igneous "or eruptive rocks, through those that are stratified," as they really can be seen to-day in Jamaica. The other set—(13 to 17) exemplify *theoretically*, how these intrusions of metamorphic, igneous, or lower stratified rocks are *likely* to have taken place in Jamaica, in spots where dislocation, or destruction of strata has occurred; but where, at present, we have only the probability of wide experience, and previous observation, to guide us, as to the *immediate* underlying strata, or other rocks; and the contingencies of their containing profitable and workable metallic veins, or *other* mineral deposits of value. The colourings of all these diagrams (7 to 12, and 13 to 17) are, for each strata and formation, respectively, the same as those used in the previous maps and plans, (4 to 6) and I will now say a few words, as simply as I can, on the sets 13 to 17.

(*n.*) No. 13, then, represents the various strata, as having been partly washed and cut away, by a valley of erosion—down to the metamorphic, or igneous rocks.

No. 14. The strata here have been broken through, and slightly (and probably slowly) upheaved, so that they now lean towards, and upon the intrusive rocks; but the *upper* strata are less removed than, and still over-lap the lower ones, that are beneath, in descending series.

No. 15 is a more pronounced example of 14; so that the upper strata are cut off *before* the metamorphic and intrusive rocks are come to, and the lower strata, in these cases, *do* shew, and are more and more exposed in descending series, *i.e.* the lowest most, and they all shew, as it were, *edge on*, until the lowest strata are brought to the surface, much upheaved, and resting diagonally, and sometimes all but vertically upon the exposed metamorphic and igneous intrusions.

No. 16. is a still more violent illustration of intrusive action; but in this case, it is, of more localized effects, from the internal forces; for the metamorphic or igneous rocks have been either ejected rapidly to the surface, and have vitrified in cooling; or in these cases, (16) the upper strata, (where they still exist) may remain comparatively undisturbed; (as in fig. 14.) or else, thirdly, the heat has been so locally intense, that it has just metamorphosed, without upheaving, and has only altered, for a few feet or yards, the edges, or flanks of all the strata, from top to bottom, so energetically broken through, (although not much raised) when the red hot or liquid rocks have come suddenly in close contact with those previously stratified.

No. 17. shews how a part—say of 3 or 4 Quaternary or Tertiary strata, (*each* still in proper order, under the one above) may be upheaved to form the top of a hill: so breaking off utterly, on *one* side at least, and sometimes on *all* sides the connections with the previous continuations, still existing at lower superficial levels: and the metamorphic and igneous rocks are shewn, as filling in what would, otherwise, be a valley of disruption, erosion, or denudation; and therefore this No. 17, —by just supposing the parts marked A, and AB, successively removed, will also serve to shew, how we get to exposed porphyritic and granite dykes and ridges, at *high levels* and, even to vitrified, and all but volcanic peaks; but nothing like a volcanic crater has yet, I believe, been discovered in Jamaica: I *have* heard of something like a crater at Newton in St. Andrew's; but unless there be scoriaceous and lava rocks, I should not think a mere funnel like depression a crater—but rather such a sink-hole, as is common in our Tertiary limestones, and might occur in friable, or soluble igneous rocks. See Lect. I., part IV. sec. *k* page 41; and part III, sec. *k*, page 25.

(*o*.) Now if we look again to map 4, you will see. I have put open rings in black, large enough to be plainly seen, on some spots in Clarendon, Port Royal Mountains, Portland, &c. These rings shew where mining efforts have already been attempted in Jamaica, chiefly for copper; and on the "rule of thumb" method—not a bad one sometimes, and when you have no better, as I have already shewn in this lecture (part III. secs. *c* and *d* pages 13 to 15).[*] It was so in these cases, *i.e.*, the rule was good, because the metallic indications, (mostly oxides of iron, or sulphurets and carbonates of copper) have, (in the places indicated) made themselves manifestly, and prominently present. And it is at these same spots, or others like them, that we must try once more, and in the first instances; if we are ever again "to go in for" metals in Jamaica. Now I want you to notice, in connection with the coloured Geological Map, No. 4, and the diagrams 13 to 17 (on which last, I have just been trying your patience,) *whereabouts* these *safe*, (because abandoned) mines are located. *They are all of them*, either in the igneous and metamorphic rocks themselves, or at the junction of these, (as shewn in Nos. 13 to 17,) with some, or other of the stratified formations; these last forming—as miners say—"hanging walls" to the metallic formations, and very frequently to the vein, or lode itself. I do not say that metallic formations are *never* found in stratified rocks, or in alluvial soils; but except for iron and gold, I at present doubt, whether most practical miners would go to sedimentary rocks to look for metallic veins, or believe much in their quantity and richness, even if found therein. I should not then—"as at present advised,"—as the lawyers tell their timid clients cautiously to write,—I should not recommend shaft-sinking and powerful pumping gear to be used in working, or following on for (say) copper in Tertiary rock in Jamaica; when the metallic veins show no signs of connection with, or derivation from intrusive rock, or at least much older stratifications, than any thing we have yet found, or are likely to find in Jamaica. Of course there is no rule without its exceptions; and mining rules are like those for teaching *from books* to English boys, the genders of French nouns; and these last (as I found to my corporeal cost, nearly 50 years ago), have under almost every rule, more "exceptions," than illustrations or examples. I say then, by percolation and deposition of gravity, by injection, and by vacuum-suction (as it were,), by chemical affinity and precipitation, and probably most of all, by electrolysis, all sorts of metallic veins, and even lodes *may*, occasionally, find their way into the sand, clay, and lime of Primary and Secondary, and even of Tertiary and Quaternary stratifications; but I should think that Mr. Jehu Hitchings, when these indications were pointed out to him, as "Copper lodes," in our Jamaica Miocene limestone, must have gone as far in the expression of an immediate opinion, as with pursed lips and knitted brows, to have slowly, solemnly, and horizontally "shaken his head at them;" and in that case, I should not have cared to say him "Nay."

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[*] Pythagoras probably discovered, and at *first* tried to work out by "*rule of thumb*" his grand secret of the proportion between the sides and diagonals of squares, unearthed in note to part III, section *c*, page 15 of this lecture. For if you make *a square* figure of 18 inches to the side, you will find the diagonal, (as near as you can measure fractions of an inch) to be 25, 29-64ths inches. Then putting x for side, and x plus d, for diagonal; you can make the proportion: As 18 is to 25, 29-64ths: So is 1 to x plus d: turning this proportion into an equation, we get 181 over 128, equal x plus d; and reducing this fraction to a decimal, we obtain 1·4140625. But this result induces us to enlarge our square, from inches to feet or yards; (that we may measure *more exactly still*). When we have measured near enough to get the side of the square as 18, and the diagonal as 25, 117-256ths, we find the decimal value of this diagonal, proportionate to the side, to be 1·4142 &c., and indeed the closer still we can measure this diagonal (as proportional to the side of the square) the nearer and nearer we get to the *square root of Two!* which is a Surd, as follows, 1·4142136 &c; for if you multiply 1·4142136 &c. by *itself*; you will get the whole number Two. Therefore side of a square is to its diagonal as 1, is to the square root of 2; and the distance of Venus from the Sun being 1, the distance of the Earth from the Sun was (according to the Pythagoreans) equal to 1·4142136 &c.; and they were not very far wrong; still they worked it out, neither by arithmetic nor by algebra; but chiefly by geometry, [*i.e.*, making x plus d, the side of *another* square, the area of which was proved (or *guessed*—because 2 is double 1 and 4 double 2) to be *twice* the area of the *first* square; so getting to the root idea of the more celebrated theorem of Pythagoras, which we now have as Euclid, Book I. 47]: But also by geometry helped out, doubtless, with a little logical metaphysics, and faith in, and sympathy with material co-incidences, and universal harmony and design:—Hence mathemetical was looked upon, as *almost* as sacred as moral truth; and even Plato, (B.C. 430), whose philosophy was, on the whole, rather spiritual than material, could set up over the door of his Academy at Athens, "*Oudeis ageométreetos eisito!*" "*Let no one ignorant of Geometry enter here!*" So too, might still say the guardian spirits of the sciences of Astronomy and Geology,—of the arts of Mineralogy and Metallurgy.

(p.) It has often been put forth against us, the natives of this island, (and by birth I am myself a Jamaica boy,)—I say it has been put forth, by some Europeans and Americans—by such, even of them as have been long resident here, that Jamaicans "from top to bottom," and "from bottom to top" are all alike sadly lacking in energy and enterprise, in resource and perseverance. There is something of truth and justice, doubtless, in this reproof—not to call it reproach:—but these failings are not so universally true of us, and their censures are not so

invariably just, as our over-candid friends suppose. I have known it well, and lived long in Jamaica, since I came back, a young man, to my native land, nearly 40 years ago,—and I never knew a period, (and a search in old local newspapers will fully confirm what I say.)—I never knew a time, then, when there was not some local scheme or other being pushed to the front, for the physical advancement of the Island agriculturally, or industrially, (*i.e.*, as applied to urban enterprise,) or commercially. Such attempts, either by co-operative investment, or by benevolent subscription for 40 years, at least, have been made here, over and over again. "What's the matter with you, Jack, that you are looking, lately, so lantern-jawed and puckered up?" said one horsey man to another—"Oh, I am down on my luck and *stiver-cramped*," was the reply. "*Impecuniosity*," to use a Micawberism—rather than lack of energy, has been the *fons et origo malorum* with us, Jamaica-boys. We are like the Irish, in one respect. We get on remarkably well in every country *but our own*, and we got on well, even *here*, until the island (from a variety of causes, connected with Emancipation in 1834) had been depleted of wealth, and there had been closed against us all inlets of capital; which last is only now beginning slowly to flow back to us once more.*

There are—(I think I may venture to say, and with due regard to the daily strides forward, that universal science is making,)—there are, then, few schemes of progress and enterprise, which are, at present, being locally promoted or advertised, with fair promise of success, that have not already been tried, or at least strongly advocated in Jamaica long ago. Hitherto most of them have come to nought, or worse still, to grief, from lack of capital; or have failed on trial, with too small a capital, for want of skilled and steady imported; or cheap, native labour, when *unskilled*. to start and to work them, on fairly remunerative principles. But the inference I would draw from all this is not, that we Jamaicans should forever fold our arms, and tell our candid European and American friends to try *their* hands at it, *on the same terms*, *we* have had to work it for 50 years, and see "what sort of a job *they* could make of it." No, I do *not* advise *that* retort; for I think the time is now nigh at hand, or has already come, when our past failures will yet become valuable to us by having, at length, and at last, closed and locked every door and passage against us, save only ONE, namely, *that which must now lead to success*!†

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* Mr. Morris, our late Island Botanist, writes (of Jamaica and the other British West Indies) in the *European Mail*, (as quoted by the *Colonial Standard* of November 4th, 1889) as follows: "The land and climate are there; but as the "result of 50 years' depression, capital has flowed to other channels, and left these islands completely barren of means."—But neither Mr. Morris, nor I, mean that we *regret*, on the whole, the work of Emancipation, or could wish it now in, its main scope and purpose, *undone*; but at last, even in England, the real truth about Jamaica is becoming slowly known, and the true causes of British West Indian decadence are at length, and in the mother country, being understood.

† Helmholtz says, "It would be a stroke of skill always to prognosticate falsely."

(*q.*) That this last saying of mine may not pass as mere "bunkum" and clap-trap, let me now take up a few stitches I was forced to drop in my first lecture. (Part III. on Economic Geology). I said that if ever mining could in Jamaica be got to pass beyond the "speculative" stage, that there are certain elements of probable future success, which did not exist thirty years ago—(when endeavour only ended, in Jamaica, at least, in failure and loss)—to make the mines do better in the future, than they could possibly have done in the past.

(*r.*) I have already adduced the advantages of railway and tram-car extension, as the means of giving facility and cheapness, for the transport of heavy mineral ores, and other crude, or partly manufactured materials. And speaking of tram-cars, reminds me to remind you of the Old Harbour tramway, which was put down, failed, and was taken up; but it proved that the railway was a necessity, and its extension would pay, and so the old railway was lengthened, first to old Harbour,—(from Kington and Spanish Town)—and next on to Porus in one direction, and to Ewarton in the other; and now we are trying by hook, or by crook, to get it extended to Montego Bay and Port Antonio.* It is in the same line of digression, with the purpose of collateral illustration, that I further remind you that the first attempts to manufacture ice in Kingston, (in the face of a strong and long established Boston monopoly) failed. But to-day there is an Ice Factory in Kingston, in full operation, and the Boston Ice Company has, after 30 or 40 years undisturbed and lucrative possession, wisely retired from these shores. Our Ice Company sells cheaper, and gives facilities the older Company never gave; and yet the local Company pays, and as soon as the railways are extended, will be able to supply daily, nearly the whole seaboard of Jamaica, at reasonable prices, with manufactured ice. So too it is with the Kingston Tramcar Company, with its 16 per cent. dividends. It is succeeding so well, that we hear, we are to have a Waggonette Company to share profits, by the plan of opposition and competition † "Bless you both my children!" as the rustic father of the British stage, says at the end of the usual metropolitan drama.

(*s.*) But cheap ocean freights will aid us quite as much as local facilities of transit, in regard to the future development of our mineral resources. The cost of freight, both by sailing, and also by steamships, is much reduced to what it was 30 years ago. As in both my lectures I have tried to keep clear of agricultural subjects,—(strictly so called) —as much as I possibly could; so I do not presume now to trespass upon the province of Commerce; but by way of futher illustration, I would say, that the cheapening of freights, quite as much as the rise in price of the commodity itself, has been the cause of the wonderful expansion of our logwood trade, during the last 20 years. It has been in this case, just as with the art of printing—which although in use in Europe, for more than 300 years, did not come to its full modern utility—(some would even say to its present perversion)—until *paper* could be manufactured, free of duty, in quantity, and very cheaply. I am old enough to remember when logwood could not have been exported at then current rates of freight. It was, however, taken in comparatively small quantities, at reduced rates, by our "old time" sugar "tubs," as stevedores' dunnage, to "chock" the hogsheads and rum puncheons in the ship's hole, and to prevent shifting of cargo and damage on the voyage "home".

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* "The People's Railway" to Stony Hill, from Kingston, was projected 30 years ago; by it, it was proposed to anticipate the existing tramway to Constant Spring.

† Six months after this lecture was given, the waggonettes are running all over Kingston. A year or two ago, a fine old patriarch of my congregation at Allman Town, was buried by me. Sixty years ago, he was "a free negro,"—kept and himself drove one of the *two* 'buses, or cabs, that Kingston then boasted of. If "up-town" folk, (who had not gigs or carriages of their own, or those of their friends at their disposal), wished to go "down town" for a little shopping, &c.; it was expedient to secure "McKenzie's 'bus," at least 3 days beforehand. There are now- despite cars and waggonettes—131 'buses running in Kingston. Perhaps our urban means of locomotion are, at present in Kingston a little in excess of what will pay all adventurers in this matter.

(*t.*) Again, under these views of Economics, with regard to Geology, and specially as to mining, I would now say something more of coppor, iron and other pyrites than I could say in my first lecture (part II. sec. *p*, page 16, and III. secs. *k* and *m*, pages 24 and 26), I have not seen pyrites in chalk here; in fact, I doubt if we have any of the *older* Secondary chalks in Jamaica at all; as our chalks are Tertiary—mostly so at least—and "diatomaceous" rather than "globegerinous;"—that is to say, they contain vegetable in excess of animal remains, and are formed probably, by disintegration and re-deposition of older calcareous earths, rather than from the direct *organic* evolution of calcium, sulphur, iron, &c.. &c. from salt water, or from the living beings and zoophytes having that element as their habitat. But of all sorts of pyrites, in other formations than sedimentary lime and chalk, we have plenty in Jamaica: far too much, indeed. for the taste and profit of our mining adventurers in times past. In St. John's, very often, my church-folk, and school children, knowing that I was fond of that penitentiary drill—"breaking stones"—would hurry up to me, by the wayside, or specially visit the Parsonage with some rough, loose metallic grains, or with a piece of metamorphic rock, veined with yellow pyrites, and they would say—"Oh! parson, here's some gold we've found!"—Now, our poorer sulphurets, carbonates, and silicates of copper, and oxides of iron are often charged with sulphur, are indeed themselves pyrites. Twenty-five years ago, this pyrites rendered most of our cupreous deposits, in Jamaica, wholly unworthy of the charges for shipping, or even of carriage; and therefore, even when they were extracted, with the proceeds of richer veins, all the "pyrites" was either "dumped" at the pit-mouths of the mines, to level and solidify the land, or else it was just shot down the gullies and water-courses, to get rid of it. These pyritical minerals, however, (when they contain sufficient sulphur,) can now themselves be chemically utilized for manufacturing purposes, on amount of the very sulphur they contain. This process is called "recovering the sulphur," as by it much of that substance, which has been quite volatilized, (say in working up indian-rubber goods for instance,) can be re-condensed and used over and over again. The supply of volcanic sulphur is both scanty and precarious, and it is a trebly dangerous pursuit to *collect* it: so the price is always dear, but also fluctuating: therefore manufacturers are giving all their support to "recovering sulphur" from pyrites. There are then at this moment mines in Spain, poor in metals, which are now worked, and pay chiefly on account of the pyrites they contain. I know—(not 15 miles from this spot)—an old mine, from which an easy tramway, all down hill, could be made, less than 6 miles to the coast. At this time there are still some two or three hundred tons of crude (iron and copper) pyrites remaining around the old shaft, and the scarped hillside is richly veined with it:—I went down the shaft some 30 years ago. It was only 160 feet deep, I believe then, and it is full of water to the brim now, with some old machinery still at the bottom. (By the way this hole is unfenced and dangerous, but it is on private land—not mine;—I visited it some two years ago). More than twice the present quantity of pyrites was originally deposited and abandoned there; but much has been carried down by rivers and floods, and thus dispersed in the neighbouring water-courses. Sulphur is being more and more needed in many arts, and it might possibly pay to overhaul some of these old heaps. As I have said in lecture 1st,—I am not a chemist. and therefore the following remarks may not only be crude: but in some respects impracticable or even erroneous; but it appears to me that the carbon-dioxide (or mon-oxide) and also the sulphurous acid gas, given off in the process of making "regulus of copper," (to which I shall presently allude,) might be collected in removable pressure-drums, and as these gases are of different gravities, they could be mechanically, or if needful chemically separated, and then, in the case of our trying copper smelting in Jamaica, the carbon-dioxide might be purified for use at our "soda water fountains" and factories, instead of importing such in drums, as I believe is at present the case; or these gases unitedly, or separately might be utilized in solving our Kingston sewage and drainage questions. For lime (as I shewed in lecture I.) ought to be plentiful and cheap in the neighbourhood of Kingston; and if our sewage were treated with quick-lime in gasometers. volumes of ammonia would be evolved, and this volatile gas might be fixed by the corbon-di-oxide (or mon-oxide) and also by the sulphurous acid above alluded to; if the copper, in the "regulus," were too poor to take up all the sulphur; so that we should get two valuable agricultural manures, carbonate of ammonia and sulphate of ammonia, and the spent lime residuum and fecula. as a third manure; while the deodorized and disinfected sewage water might be run, all but harmlessly into the sea or without any public nuisance in transit, be moved by steam tanks. and let off outside Port Royal. Or the ammonia might be otherwise utilized with that given off at the gas works, in supplying the condensing pumps of our ice factories. The above hints are quite consistent (if economically practicable,) with any sewerage system, that may possibly be adopted; although best suited to the earth closet arrangement. Or further, supposing—by anticipation—that we have got our "regulus of copper," manufactured at the mines, might we not at the west end of Kingston, beyond the slaughter house, take the bull by the horns—and go to work on our own "regulus of copper" by smelting out the malleable copper. and by manufacturing from the residue, sulphuric acid, and with the aid of the neighbouring sea water—making also muriatic acid. Both which are very expensive and dangerous to import, and which may be expected to find local use if they can be cheaply supplied.* We may have to import coal or coke as fuel for these manufactures, (unless some of our carbonaceous shales can be utilized, as may be the case for these purposes): but as I believe, that despite some blunders I may have made, that the scheme is feasible, so I am quite sure also, if it be done as an adjunct to mining, the whole thing will pay handsomely.† Previously, even in England, the sulphur in iron and copper ores was a positive nuisance, and had to be "roasted off" in open pits or heaps with "beeze" coal, (so that the hydrogen and carbon in the coal, and the oxygen in the air might release the sulphur)—but this was done at much expense and delay, trouble, labour, and loss of fuel, and material before the ores could be smelted at all, even although duly mixed with their proper fluxes. So what was heretofore a detriment and cause of loss, has now become a gain, or at least a profitable reduction of working expenses: and all *honest* profit is only "Margin"—But this is not all that is to be said about our future mining prospects. If wood fuel would do. (and I think it would)‡ we could—in part at least, reduce and concentrate our copper pyrites, in local reverberatory furnaces, not only in Kingston, and other seaports, but also at the pit-mouths; thus forming for shipment—(even if we could not manipulate it ourselves) a "regulus" of copper containing, say 60 per cent. of smeltable metal and 40 per cent. of "recoverable" sulphur. This "regulus" can be made even from poor copper ores of less than 10 per cent., first yield of dressed ore; by repeating the process 2 or 3 times over, and so concentrating the bulk and weight of the product, and likewise adding to its value, that it may pay all the expenses of local smelting, and bring down the freight to Europe or America to a minimum. I am not myself practically conversant with the process—for I have never seen it worked, but the theory of it is sufficiently simple; and it is less "speculative" than some of the hints I have already thrown out, as to using up our pyrites locally. The process is in operation in other countries now, and it is this:—the chemical affinity between copper and sulphur is so strong that it was with the greatest trouble, (as I have already partly explained), that the older metallurgists were able to separate them, and the pure copper will not run free of sulphur out of the slag, whilst it is influenced by the sulphur. The metal will burn up, rather than part with the sulphur;—so sulphur and copper must, in the *first instance*, be run out together,—and this can be done comparatively *at lower temperature*, and the "regulus" thus obtained must then be treated, by the process I have already referred to, for the "recovery of the sulphur," and thus the copper is at last itself got pure. So it was a "happy thought," when it struck someone to adopt the device of King Charles II. It was reported to the "Merry Monarch" of that turbulent vassal, the Earl of Kildare: (Mr. Gladstone evidently knows the story, but hitherto, I don't see that, he has thought it politic, in support of Irish Home Rule, publicly to quote it): it was said then of this Earl, that "all Ireland could not control the Earl of Kildare." "Well then," said the King—"let the Earl of Kildare control all Ireland," and so that nobleman forthwith became lord lieutenant.* In like manner, since the sulphur will not readily let the copper go, (naturally combined with it, in the metallic ore,) then make the sulphur *take up* all the copper it *can* grasp and retain, and thus turn poor sulphurets, carbonates, and silicates. (pyrites) into rich "regulus of copper," which will pay for carriage from the mines, and shipment, even in Jamaica—quite as well, or perhaps better. than sugar and coffee, can at present, or are again ever likely to do. When the "regulus" gets into the hands, either in Jamaica, or elsewhere, of the scientific manufacturers, they will know how to separate those two cronies (sulphur and copper), whom heretofore flame could not part, nor floods divide; and will put both of them to their several and profitable uses. As these matters are in fact, both the *bower and sheet* anchors of our mining prospects in Jamaica, (a mixed metaphor I confess); since they will make even poor mines pay fairly well, and rich ones far better than of old—I would now refer to my first and chief authority in my text rather than in a note.† You will find all about it in the Encyclopædia Britannica, last edition, (to be seen at the Jamaica Institute), vol. XVI. (Men to Mos) Article, Metallurgy, pages 60 and 61, under the head of "Sulphides." But as I have already tried to put in a popular form, what you will there read in its scientific expression, about the manipulation of copper pyrites, I shall not now trouble you with the *ipsissima verba* from the Encyclopædia itself, and will now try to summarize the applications I would draw from the whole matter. As then one grain of weight will transfer the tilt of a delicate scale-beam, from one side to the other, so it is at times with those equally minute variations in the first cost and value of crude materials, and still more so, as to the market price of finished commodities. Whence therefore often arises for producers, conveyors, and consumers alike, (or in turn), the difference between scarcity and supply—poverty and plenty. The test of a tenth of a farthing per yard, or per pound in the wholesale selling price, will often settle in England, whether a large cotton mill shall go on, or stop, and whether a smelting furnace shall remain "in blast," or be "shut down."

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* Mr. D'Israeli was once severely laughed at in the smart London Liberal journals; because when he was Chancellor of the Exchequer, in a time of great commercial depression, he anticipated a better time coming, from the fact that the price of, and quantity manufactured of sulphuric acid, had recently been increased. The "Manchester School," although politically opposed to Mr. D'Israeli, still, as manufacturers, knew that he was perfectly right.

† Thus the silver mines of Laurium in Attica, from which the Athenians of yore extracted the metal of their world-famed "owls" (See part I, sec. *b*, page 4); but which mines were supposed to have been exhausted, during the Macedonian dominancy; are now being re-opened, and re-worked, for the twofold purpose of going further, and sinking deeper into the mines, than 2,500 years ago, there were mechanical appliances to do; and secondly, for "working over" the "slag," and getting out of it more precious metal than, perhaps, the first miners did from the ore as originally quarried, in the days of Pericles and Alcibiades.

‡ See Mr. Sewell Gana's letter at the end of **these lectures—Appendix B.**

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* At his decease, the following epitaph was devised for him:
"Who killed Kildare? Who dare Kildare to kill?
"Death killed Kildare, Who dare kill whom he will!

† But see again—Appendix B, and copy therein given of Mr. Henry Sewell Gana's letter to the *Gleaner* (Kingston, Jamaica), of March 7th, 1889.

And yet all this does not contradict, but rather confirms a contrasting and reciprocal truth laid down by Sir Lyon Playfair, (*Nineteenth Century*, September, 1888) in these words, "The mere accident "of local advantages is now a small factor in the industrial competition "of nations; for trained intelligence, required to convert them into "utilities, has become the great and growing factor of production." These words are indeed a confirmation—if such be needed—of the points I have already adopted and pressed on the authority of Mr. Herbert Spencer. (Lect. II., part IV. sec. *i*).

(*u.*) I have already said that it is by no means an uncommon thing for inexperienced persons to mistake iron and copper pyrites for gold; but the contrary error may be made—has been made—made even in Jamaica—made even by a trained and experienced Cornish mining captain; just such a man as Mr. Jehu Hitchins himself. That error is, mistaking gold for pyrites, and pitching it away as worthless material. This was actually done at Charing Cross mine in Clarendon, 30 years ago. I quote again, page 38 of the Geological Report, where Mr. Sawkins writes, as follows: "The occurrence of gold in the "carbonates of this mine (Charing Cross) was first detected by a scientific stranger":—(let me, parenthetically, express the hope that our Hotels Company, when successfully at work. will bring us many such scientific and observant strangers,) detected then "by a scientific stranger who examined the ore lying on a wharf in Kingston; but most "of these carbonates were thrown away"—(that is at Charing Cross)—"into the adjacent gullies, the percentage of copper in them being "considered too small to pay."* I quote this passage, not chiefly because it does certainly remind us very strongly of another good story,—namely that of the rustic mother of an English Jack-tar, who, in the earliest days of the China foreign tea trade, received as a dutiful tribute of affection from her absent son to his widowed mother, a precious pound of the fragrant herb; she, however, good old soul! having first well boiled the leaves, threw away the cabbage-water, (as she deemed it to be) and tried to eat, with bacon and black pepper, the stringy residuary spinach. but did not think much of it, and "only worried it down" "for dear Johnnie's sake." The further quotations from the Geological Report which I have made, are really given for a more serious and important reason than to tack a joke to them; and for this more staid purpose I have rescued them from my suppressions under the head of "Speculative Geology," namely, because it shews that the water courses leading from Charing Cross old mine have been unintentionally "salted" with gold ore of some value, and this fact if generally forgotten may have serious effects: (and real facts are usually forgotten—myths and second-hand traditions fasten themselves much more permanently on the popular memory, than facts do). Now I say when this fact about the gold ore pitched away at Charing Cross is forgotten—as it will be again forgotten; although I have revived it here; it may one day lead to disastrous mining and washing for gold in the neighbouring districts: but of course in the *wrong* places.† But per contra, I may allege another little mineralogical fact. that may be of use to us, when this Charing Cross, and other such mines are re-opened. We all know that "money makes money." I will not go into the bi-metallists query whether after all, gold be really "money"; but I will just bluntly and literally say, that gold that is visible, transmutes, or renders visible gold that is invisible, as the old alchemists thought; only they were (as I have said of other ancient sages) tentatively working true ideas in a pre-scientific age.* I ought rather perhaps to say gold gathers gold—for if there be at the bottom of this Charing Cross mine, any chemical action going on by which chlorine (which is, in one of its compounds, a solvent of gold) in any of its forms, is being distilled or precipitated; then the old copper-mine workings may one day become worth pumping out, and for a time at least, reworking as a gold mine; from the precipitation of chloride of gold into solid metal. In Australia and California such old gold workings (and they are none of them 40 years old yet) have nevertheless sometimes been found profitable when reopened—even the old rotten timber shoring and battening have been found not only incrusted, but permeated with filaments or small nodules of gold. Perhaps we have here some inkling given us how gold nuggets have actually grown around, as it were, such nuclei of vegetable fibre, animal fossil, or affinitive mineral. But this is beyond my present brief—and I will now just show you one by one, and rapidly, some poor specimens of Jamaican copper ores, and some typical minerals imported from other countries, and which you can observe more at your leisure in the cases (when replaced there) of the Jamaica Institute Museum—(which exhibition to the audience was hastily made, just before the conclusion of the lecture).

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* See also Geological report—Sawkins'—page 189, on the parish of Clarendon, under the head of Economic Geology—*Copper*: the whole section should be carefully read, but here the following about gold, in connection with mistaking it for pyrites, is copied.

"During the year 1858, some specimens of blue and green carbonate of copper, from either Stamford Hill, or Charing Cross mine, were given to the Hon. Lewis MacKinnon by the late Hon. Edward Thompson, as specimens of copper from the Clarendon mines; as such they were regarded, and on Mr. MacKinnon's leaving Halse Hall where he then resided, these specimens of copper ore were thrown away. While I was surveying this parish, I occupied the house at Halse Hall, during which time Mr. Charles B. Brown, the assistant geologist, while on a visit to me, discovered a small piece of these said specimens, and on close examination by him, it was discovered, that what had been considered by the miner's as copper pyrites was truly gold; subsequently another and larger piece was examined and found to contain sufficient gold to be considered a gold ore, the value of which was estimated at from £60 to £70 per ton, besides the copper which would yield from 12 to 15 per cent."

† Of course gold *may* be found *one day* near Charing Cross, or in gullies leading from there, without being gold *from* Charing Cross old mine. Since this lecture was given, I have been hearing rumours of gold being found in the Rio Minho, *and I partly* believe it.

(*v.*) But it is time for me to close my case, and submit it to the summing up of our chairman to-night, as judge, and to you, my long suffering audience—as the jury; but without ignoring or contravening that analogy, I should like now to point my remarks of to-night in the direction and to the end, to which I hope, your suffrages will help the Mining Prospects of this island speedily to arrive. In my conclusion I doubtless shall, to some, appear to come to a very small anti-climax; like the Frenchman who tried to express in English his admiration of something—"*brilliant!—superb!!—magnificent!!!—pretty good:*" said he. I have, however, tried to-night to address myself more to your reasoning faculty and judgment, than to your imaginative ideality and emotional instincts; and I hope you will not think that I am bringing my lecture to a very prosaic conclusion, when I say plainly that my object, all along, has been, to get you to see the necessity of having a highly scientific and competent man imported as Island Geologist; to rank in pay and status with our chief Inspector of Schools, our Island Botanist, Island Chemist and Crown Surveyor. If the Island Geologist (when we get him) would not wholly ignore the fact that there were wise and good, as well as brave men before Agamemnon—and yet would also go about—and see for himself, before he formed positive or negative conclusions; and if the Government would send him—(in the interests of Palaeontology) to the Isthmus of Panama, (where I believe the fossils are the same as ours); and if in the cause of future mining in Jamaica, he were also to visit the other West Indian Islands—especially Cuba, and its copper mines; and if it were physically possible, and from political disturbances, or national jealousies not wholly unsafe, to go into the interior of St. Domingo, and explore its highlands; I think it would be better for him and for us. Our Island Geologist must be a man of sufficient professional celebrity to remove all suspicion that he would be only "an official putting in his time," to enable him to pocket a stipend; so after his travels on our behalf, and when he returns to the island, our Government Geologist should not be made the head of a red tape and official envelope department; but he should have time given him to think and weigh—to collect data and to make comparisons—of Jamaican mineral indications,—with those of other countries, and not solely with Cornish and Devon mines—(as has been previously almost exclusively done); also to get authentic accounts of mining geological conditions in South America and some parts of Australasia, including New Zealand and British New Guinea. If all this were done, I am of opinion that in 5 years from the date of the Island Geologist's appointment, we should have at least 3 or 4 old mines reopened and worked with moderate profits, and probably as many more *new* ones adventured with like unexciting, but satisfactory results; and in that case I am quite sure that the increased public revenue, which would thus directly and indirectly flow into the Treasury, would be more than sufficient to pay the Geologist's stipend and cost of office. But independently of any benefit of *mining*—*i.e.* metallic—advantages to capitalists, or to the island revenue, I think, the stipend and cost of such an officer would be *doubly* compensated for—first by the great help and stimulus he could give to our higher and middle class education, intellectual, scientific, and practical; and secondly by the furtherance he would most assuredly afford to the development and utilization of our mineral wealth, which is not ostensibly *metallic*; and which in my first lecture, I insufficiently, but as some length, treated of, under my third head of "Economic Geology." Of course this official Geologist would be a Governor of the Jamaica Institute, and being *really* a geologist—"it goes without further saying," that he would be an Admirable Crichton, knowing *everything*, and able to do *anything*. And, finally, I may say that I have no son, or son-in-law, brother, first cousin, or bosom friend, ***who is just exactly suited for the post!***

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* "We are evidently fast returning to the days of Alchemy." See *Westminster Review* of August, 1889 page 195, where this is said, not ironically, but as a sober and scientific truth.

2nd March, 1889. H. S.

APPENDIX B.

Mr. Henry Sewell Gana, a mining engineer from Chili, on his way to England about mining business, happened to be in Kingston when the giving of this lecture on Jamaica, in regard to Mining, was advertised, and he therefore attended it. I had never seen him before he attended at the Mico Institution, where the lecture was given. He was pleased at the close of it, to express his general accordance with the principles laid down in it; and indeed confirmed some points on which I had spoken with some reserve, as myself lacking experimental knowledge about; specially in regard to utilizing poor copper pyrites by local smelting and concentration. The next day, without any external suggestion, (as far as I am aware) he wrote the following letter, which appeared in the *Gleaner*, (Kingston) of 7th March, 1889:—

"The lecture by the Rev. H. Scotland on the past and future of "Mining in Jamaica. Sir—I attended this lecture last night at the "Mico Institution by the above named gentleman. As a mining engi-"neer of 40 years practical experience, besides having graduated as "such in Freiburg, Saxony in 1851; I can say I highly appreciated "the able lecture on this subject. I trust that we shall have the bene-"fit of seeing it in print.

"I seconded the able lecturer's ideas. and made a few remarks as "to the cause of the great prosperity of copper mining in Chili, which "till lately produced 70 per cent. of all the copper manufactured in "the world, and stated that I believed if in Jamaica they worked on "the Chilian principle, that is smelting the ore and raising it to 60 per "cent. and then shipping it to England. Jamaica mining would have "a new lease. Copper smelting would be a very easy matter to carry "out in Jamaica. Coals from England would not be required. In "Chile it is only within the last 25 years that smelting with coal was "introduced. All the smelting had been done for a century with "firewood, but the furnace used is of a special form, as well as the "stack. I shall be glad to give the Rev. H. Scotland a small plan of "the shape and size of the Chilian copper smelting furnace.

"(Signed) HENRY SEWELL GANA,
Mining Engineer."

According to Mr. Sewell Gana's invitation to me. given publicly in the above letter, I looked him up, and had two interviews with him before he left Jamaica. He gave me some specimens of various Chilian metallic ores, with their assay percentage of gold, silver, etc., etc., attached to each. All these I have handed over to the Museum Committee of the Jamaica Institute, as our joint gift. Since his arrival in England, he has corresponded with me, and duly sent me the rough plans promised of the Chilian reverberatory copper smelting furnace. These are now being kindly drawn to scale and proper elevation for me by E. J. Bridges, Esq., M.R.I.B.A. Surveyor to the Royal Engineer's department, Up-Park Camp, and when they are finished and mounted, these also will be given to the Jamaica Institute, as the joint offering of Mr. Bridges, Mr. Sewell Gana, and myself.

September, 1889. H. S.

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